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# **SCIENTIFIC AND TECHNICAL ACTIVITIES OVERVIEW**

**Summary and Analysis  
of the 1994/95 Alberta  
Government Science  
and Technology  
Program**



## Contents

1. Preface ..... 1

2. Executive Summary ..... 2

3. Introduction ..... 3

3.1 Purpose ..... 3

3.2 Scope ..... 3

3.3 Terminology ..... 3

4. Examples of Research Activities ..... 4

5. Highlights of the 1994/95 Research Program ..... 5

6. Introduction ..... 6

7. Findings ..... 7

8. 1994/95 Research Program ..... 8

9. 1994/95 Research Program by Department or Agency ..... 9

9.1 Alberta Advanced Education ..... 9

9.2 Alberta Agriculture, Forestry and Rural Development ..... 9

9.3 Alberta Environment ..... 9

9.4 Alberta Health Services ..... 9

9.5 Alberta Industry and Technology ..... 9

9.6 Alberta Labour ..... 9

9.7 Alberta Community Development ..... 9

9.8 Alberta Economic Development and Tourism ..... 9

9.9 Alberta Energy ..... 9

9.10 Alberta Environment ..... 9

9.11 Alberta Health ..... 9

9.12 Alberta Labour ..... 9

9.13 Alberta ..... 9

Appendix A ..... 10

Appendix B ..... 10

Appendix C ..... 10

Appendix D ..... 10

# **Scientific and Technology Activities Overview 1994 - 1995**

## **Technology and Research Advisory Committee**

## **Summary and analysis of the 1994/95 Alberta Government research and scientific activities program**

**April 1994**

**A study conducted by the Technology and  
Research Advisory Committee for the Minister of  
Economic Development and Tourism**







# Contents

1. Preface .....	1
2. Executive Summary .....	2
3. Recommendations .....	4
3.1 Progress on Recommendations from the 1992-93 and 1993-94 Research Overview Reports .....	4
3.2 Recommendations from 1993-94 Research Overview .....	5
3.3. Recommendations from 1992-93 Research Overview .....	6
4. Examples of Research Accomplishments .....	7
5. Highlights of the 1994-95 Research Plans .....	9
6. Introduction .....	11
7. Findings .....	13
8. 1994/95 Research Programs by Economic Sector .....	16
9. 1994/95 Research Programs by Department or Agency .....	24
9.1 Alberta Advanced Education .....	24
9.2 Alberta Agriculture Food and Rural Development .....	27
9.3 Alberta Agricultural Research Institute .....	47
9.4 Alberta Heritage Foundation for Medical Research .....	58
9.5 Alberta Oil Sands and Technology Research Authority (AOSTRA) ...	64
9.6 Alberta Research Council .....	74
9.7 Alberta Community Development .....	83
9.8 Alberta Economic Development and Tourism .....	87
9.9 Alberta Energy .....	100
9.10 Alberta Environmental Protection .....	113
9.11 Alberta Health .....	122
9.12 Alberta Labour .....	131
9.13 Alberta Transportation and Utilities .....	136
Appendix 1 - Participants in Overview Study .....	143
Appendix 2 - Recommendations from 1993-94 Research Overview Report .....	144
Recommendations from 1992-93 Research Overview Report .....	146

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# 1 PREFACE

In today's rapidly changing world, technology is one of the major determinants of wealth and quality of life. Research and Development are fundamental to technology based industries and services and the ability to meet the changing needs of our province.

**It has been shown that research and development outputs have a direct impact on wealth generation, job creation and overall economic and social development. Innovation and especially technological innovation accounts for at least 70% of growth in the economy.**

*Seizing Opportunity*, Alberta's new economic strategy announced in the spring of 1993, has clearly pointed out that "based on the realities of surviving and succeeding in today's world, we must adapt quickly and aggressively in order to position Alberta for future growth". It also identified that "modern infrastructure is an important component in economic development ... (and) necessary ... to promote economic growth". Considering that "science technology and industrial innovation are critical components of economic growth and diversification", in order to thrive in this situation, Canada and Alberta need:

- to have free access to as many markets as possible;
- to be able to acquire the best available technology in all fields we wish to engage in;
- to be able to adapt the technology acquired or develop our own technology if we can't acquire what we need; and
- to develop a culture that will enable our companies to thrive in the future marketplace.

There is the need to have a technology development program appropriate to our future needs. Such a program must be backed up in part by a related research program in those areas of importance to the likely future direction of the province.

The role of government in planning, funding and performing research is an integral part of the whole research process to ensure that the longer term goals of society are addressed.

The wealth of a country and the well-being of its citizens today does not necessarily depend on the particular local natural resources, but on the ability to make more and better use of all the resources. In order for these resources to benefit our province we need to know how to make better use of them to our advantage. Technology is the knowledge and ability to make more productive use of our raw materials.

Even though un-implemented technologies owned by an organization or country are a measure of the potential for economic growth, they will only be realized if we coordinate our efforts and cooperate in developing new technology and in the application and incorporation of this technology into our every day practices and operations.



## 2 EXECUTIVE SUMMARY

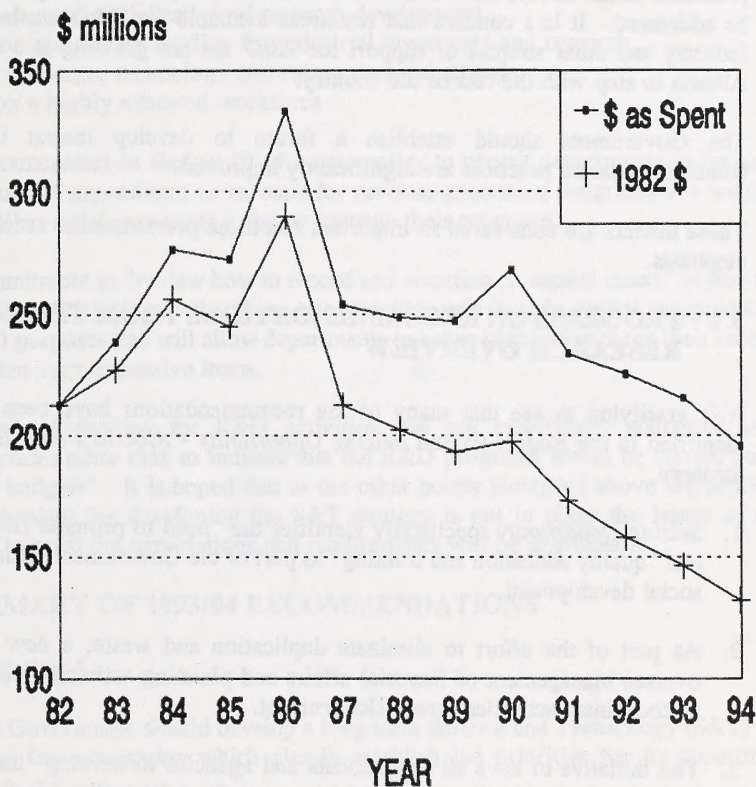
This report presents an overview of the total Alberta Government 1994-95 research and development (R&D) and related scientific activities (RSA) program and the associated budget. The 1994-95 research programs for 13 departments and agencies are presented outlining activities, budgets and expected impact on the economic and social development of the province. Examples of accomplishments are also presented.

The major points this report is addressing are:

1. The 1994/95 science and technology (S&T) investment by departments and agencies is \$195.72 million. This investment supports a range of program activities to promote the economic and social development of the province through the sectors they serve.
2. The Alberta Government investment in S&T activities which includes both R&D and RSA continues to decrease. Alberta provincial gross expenditures on research and development (GERD), which includes government, industry and university research investment, as a percentage of the total Canadian investment has dropped from a high of 12% in 1981 to 7% in 1991. Alberta Government investment in S&T, in 1982 dollars has decreased at almost a uniform rate from \$250 million in 1984 to \$150 million in 1992 (Figure 2.1).
3. The return on investment, though difficult to calculate, is upwards of three to four times the annual investment as shown by studies of a number of the research programs in the province. This is accomplished through savings in operations on services such as highway development and infrastructure maintenance and in new economic activities.
4. The investment provides many societal benefits including improved health and quality of life for Albertans. An international team of experts has concluded that Alberta is one of the ten top medical research centres in North America, thanks to the Alberta Heritage Foundation for Medical Research (AHFMR).

# Figure 2.1 Annual Investment in Scientific Activities

(R&D and RSA)





# 3 RECOMMENDATIONS

No new recommendations are presented in this report. However, the Government should move at once to implement a mechanism to implement research coordination, referred to as the Research Coordination Council in the first edition of *Budget 93 and Seizing Opportunity*. The recommendations presented in the previous two annual *Research Overview* reports, presented in full in Appendix II and summarized below, are still very relevant and each should be addressed. It is a concern that resources available for R&D are being seriously eroded. Industry and other sources of support for R&D are not growing at a sufficient rate to keep Alberta in step with the rest of the country.

The Government should establish a forum to develop means by which technology commercialization practices are significantly improved.

These matters are considered so important that these points need to receive renewed effort and emphasis.

## 3.1 PROGRESS ON RECOMMENDATIONS FROM THE 1992-93 AND 1993-94 RESEARCH OVERVIEW

It is gratifying to see that many of the recommendations have been addressed by actions identified in the *Budget 93 and Seizing Opportunity - Alberta's New Economic Development Strategy*.

1. *Seizing Opportunity* specifically identifies the "need to promote research and technology" and "quality education and training" as part of the Government initiatives on economic and social development.
2. As part of the effort to eliminate duplication and waste, a new management board to oversee management of financial affairs and planning activities will provide a mechanism to coordinate activities across Government.
3. The initiative to have all departments and agencies to develop "three-year business plans and to tie future funding to the achievement of results outlined in the plans" will similarly provide greater ability to coordinate and plan R&D activities.
4. The commitment to improve management and coordination of R&D activities and budgets and the development of a comprehensive strategic plan with clearly identified research priorities is supported. Through the process and structure that will be developed to address these issues it is hoped that a clear Government strategy on S&T and R&D, as recommended in previous Research Overview Reports, will be formulated to allow the departments and agencies to develop clear plans and programs to meet this strategy. This will provide a clear indication to industry of a Provincial commitment to research and economic growth. Each department and agency has been requested by TRAC to develop an R&D short and long-term plan as an integral part of their overall business plan.



The Technology and Research Advisory Committee (TRAC) has also asked each of the departments and agencies funding and/or performing research to identify plans for a detailed evaluation of their past and existing programs to identify their effectiveness and their impact on the economic and social development of the Province.

5. The commitment by the Government to the following points identified in *Seizing Opportunities* also address recommendations made in the previous Overview Reports.
  - develop innovative models to foster research and development
  - focus on commercialization of research development
  - examine options for funding for industrial investment and research
  - foster a science, technology and entrepreneurial attitude
  - develop a highly educated workforce
6. The announcement in *Budget 93* of a new policy to permit departments to budget for the net amount of expenditure or revenue for revenue-generating programs is a welcome step toward allowing departments to better manage their programs.
7. The commitment to "review how to record and amortize ... capital assets" is also a positive development. It is hoped that these two activities will include capital equipment required for R&D purposes and will allow departments to better plan and manage their resources for these often very expensive items.
8. The level of funding for R&D activities was not specifically addressed in *Seizing Opportunities* other than to indicate that the R&D programs would be carried out "within existing budgets". It is hoped that as the other points identified above are addressed and the mechanism for developing the S&T strategy is put in place the issues of sufficient funding to meet the expectations and requirements will be addressed.

## **3.2 SUMMARY OF 1993/94 RECOMMENDATIONS**

### **Recommendation 1**

The Alberta Government should develop a long-term Science and Technology (S&T) plan with strategies for implementation which clearly establish the priorities for its departments and agencies.

### **Recommendation 2**

Each Alberta Department and Agency should develop long-term R&D plans with long and short term strategies for implementation and including the expected impact of the activities. Approvals for these plans should be sought through Request for Decision (RFD).

### **Recommendation 3**

Departments and Agencies which perform and fund research should be given the ability to manage their funds over periods longer than one year by having approved rolling 3 to 5 year

plans, with the requirement to carry forward surpluses and deficits into the following year.

#### **Recommendation 4**

Departments and Agencies should develop plans to ensure and maintain a high level of human resource capability and facilities to achieve their mission and goals.

### **3.3 SUMMARY OF 1992/93 RECOMMENDATIONS**

#### **Recommendation 1**

The Alberta Government should make technology-based industrial competitiveness a major goal for this decade.

#### **Recommendation 2**

The Alberta Government should increase and maintain its research investment at \$300 million per year.

#### **Recommendation 3**

The Alberta Government should put top priority on programs to substantially increase the industrial commitment to R&D.

# 4

## EXAMPLES OF RESEARCH ACCOMPLISHMENTS

A few of the achievements of the programs funded in the past few years are listed below. Many equally significant accomplishments could have been described that show the value of the Government investment in Research and Technology Development.

- One of the wells at the Underground Test Facility (UTF) pre-commercial project using the Steam-Assisted Gravity Drainage Process developed by AOSTRA, is producing in excess of 600 barrels of Athabasca bitumen per day, placing it among the top 64 of the almost 25,000 oil producing wells in Alberta. Three companies have expressed strong interest in taking over operation of the UTF project starting April 1994. It is intended that the new operator will lead an industry consortium to develop a commercial project on the lease.
- The HC<sub>3</sub> bitumen upgrading process developed jointly by AOSTRA and the Alberta Research Council has been successfully demonstrated at conversion levels above 95 percent with pitch recovery, resulting in a potential cost saving of a further \$1.00 per barrel over the basic process presently used.
- The Aglofloat sulphur removal from coal technology developed by ARC and Alberta Energy was recently licensed to a major international company.
- The reduction of lost-time accidents in Alberta dropped from 37,700 in 1991 to 33,500 in 1992, resulting in direct savings of over \$59 million. The reduction in part can be directly attributable to programs designed by Occupational Health and Safety and research into preventing occupational injuries.
- The Province has a \$1.9 billion investment in bridges. Research into the predicted service life of bridges identified appropriate rehabilitation techniques to be applied at times to reduce maintenance costs. Savings of up to \$2 million annually are expected in deferred replacement costs.
- The introduction of expert systems and development of some 14 systems applicable to highway design, operation and bridge maintenance promise to show savings of some \$2 million annually.
- Custom de-inking technology developed in a joint venture between Alberta Newsprint Company and Alberta Research Council turns waste paper into newsprint and de-inking sludge into a soil supplement. The process reduces de-inking costs by \$5 /tonne and separation costs are eliminated and marketing the technology is expected to generated \$18 million over 5 years.
- Through the study of electrocardiology and activity in single cells has led to the development and testing of improved implantable devices for taming wild heart rhythms and for prevention of heart attacks.



- New therapy for spinal cord-injured patients with electrical stimulation has given paralysed people increased mobility.
- A major centre for virology research including AIDS was established at the University of Alberta, jointly funded by industry, Government and the University of Alberta.
- More than a dozen new specimens of dinosaurs or fossil reptiles were discovered, providing material for the successful Dinosaur Project: China-Canada-Alberta-Ex Terra. Field expeditions in China alone yielded 60 tons of well preserved fossil materials.
- The largest assemblage of pleistocene fossils discovered in Alberta were excavated and collected from local gravel pits. The six new species add to the accumulating evidence suggesting a different glacial pattern in southern Alberta than previously thought.
- Further diversification of Alberta's \$2.17 billion crop industry was enhanced through the development of improved crop varieties and management systems for horticultural and specialty crops including nursery crops, vegetables, seed potatoes, greenhouse crops, herbaceous perennials and woody ornamentals. A value added processed potato product containing meat was developed for test market evaluation in Japan.
- Two new soft white spring wheat cultivars specially adapted to Alberta growing conditions were developed with Alberta Agricultural Research Institute support. Soft white wheat flour is suitable for pasta and bakery products such as flat breads, cakes and cookies. The two varieties are the first soft white wheat varieties ever developed in Canada.
- A method for controlling a new swine disease in Western Canada (Streptococcus suis) was developed with funding from the Alberta Agricultural Research Institute.
- Advancements have been made in the treatment of breast cancer through the introduction of the breast screening program, the use of tamoxifen and new radiation therapy.
- A new, inexpensive portable intravenous device was developed that allows terminally ill patients in need of pain control to self-administer drugs while remaining at home.
- Mental Health Research has resulted in advantages in pharmacotherapy of depression and panic disorder, Tourette's syndrome and attention deficit disorder.

# 5 HIGHLIGHTS OF 1994/95 RESEARCH PROGRAM

Listed below are some highlights picked from the R&D programs identified by the Departments and Agencies to meet the economic and social development strategy outlined in *Seizing Opportunity*.

- Expand Alberta's petroleum industry by developing and promoting new technologies to upgrade the hydrogen to carbon ratio of the Province's fossil fuels to meet present and future environmental requirements.
- The Steam-Assisted Gravity Drainage (SAGD) technology, used successfully in the UTF, will be extended to wells drilled from the surface in a project with Shell Canada Resources Ltd. in the Peace River oil sands deposit.

Assist Alberta industry with the development and application of advanced information technologies to meet their needs.

Provide research and development support, scale-up and manufacturing capability for chemical based biopharmaceutical compounds and large scale carbohydrate chemistry production.

- The world's first horizontal well project using electrical heating is being carried out with Texaco Canada Petroleum in a thin heavy oil reservoir of the type common in Alberta, which is uneconomic for conventional thermal recovery methods. The world's first in situ combustion project using horizontal wells is being carried out with Amoco Canada Petroleum Company in the Wabasca oil sands deposit.
- Research into the development of cost effective tools for analysis of geometric improvements to existing paved roads in Alberta, such as grade widening, horizontal and vertical realignment, based on before and after vehicle collision severity and rates, promises to save \$1 million annually in road user costs.
- A program to develop an automated process for highway construction contracting should translate into annual savings of \$170,000.
- Hygiene field studies on occupational exposures to determine whether occupational exposure limits need to be changed to prevent future occupational illnesses.
- Develop and evaluate programs for more effective training of family physicians to prevent, detect, and treat alcohol and drug abuse.
- Explore the underlying cause of diseases and provide a foundation for prevention of these diseases.

- Palaeontological excavations will continue at Dinosaur Provincial Park, and the Devil's Coulee Dinosaur Egg Site, for the development of new displays for the Provincial museums.
- Studies will continue on the early man discoveries in the province such as the excavation of a 10,000 year old human occupation site at James pass, the second oldest known site in Alberta.
- Research programs aimed at minimizing production costs in beef and sheep, alternative management strategies and increasing production efficiency will be implemented.
- In cooperation with the food processing industry, research projects in product development, prototype design, shelf-life and product stability testing will be undertaken.
- The Alberta Agricultural Research Institute (AARI) will fund research projects that provide farmers and agricultural processors with new technologies to improve soil and water management techniques, crop production, livestock production, agricultural processing and generate new economic and marketing information.
- Private sector involvement in agricultural research will be encouraged by the Alberta Agricultural Research Institute's (AARI) Matching Grants program. Under the program, the AARI matches, on a 50:50 basis, financial contributions from the private sector or other eligible sources.
- The Health Services Research and Innovation Fund (HSRIF) will support studies that improve the development, organization and delivery of health services with defensible and measurable health outcomes. These projects will be ones that will enhance the quality of life and have the potential for cost stabilization or saving.
- Clinical and basic research involving prevention, screening, diagnosis and treatment of cancer, including studies of tumour radiosensitivity with oxygen, genetic or familial cancer-prone conditions and new strategies in chemotherapy.



# 6 INTRODUCTION

This third annual Scientific and Technical Activities Overview and Budget is prepared to assist the Alberta Government in the definition and implementation of its 1994/95 research and technology programs. This report will help to focus attention on the importance of research and technology to the economic, and social development of the province.

The major points this report is addressing are:

- 1) The research programs planned for the coming fiscal year 1994/95.
- 2) The resources required to carry out these important programs.
- 3) The major accomplishments and impact on the economy and social well-being.
- 4) The processes in place to develop and evaluate the programs.
- 5) The structures in place for cooperation among the departments, agencies, industry and university and the coordination of the program.

This report covers the Research and Development (R&D) and Related Scientific Activities (RSA) of the Alberta Government. The activities covered under R&D are those undertaken on a systematic basis to increase the stock of scientific and technical knowledge and the use of this knowledge to devise new applications. Related Scientific Activities (RSA) include education support, technical surveys, information services, special services and studies and museum services. RSA are generally an integral part of the day to day operational activities of the departments in providing service to their sector. As a result many departments often find it difficult to determine which activities should be included in RSA and question whether these activities should be included in this study. Since RSA often points to what research activities are required or support research activities, they form an important part of this S&T Overview.

The budgets presented identify the level of funding required to achieve the programs outlined by each department and agency. Some reductions or changes were introduced as a result of department priorities and recognition of austerity. Further reductions in funding will result in certain programs being reduced or eliminated entirely. Those programs that are performed in collaboration or cooperation with other departments, the federal government or industry will in many cases result in reduced S & T investment in the province by these organizations as well.

The reorganization of government departments has changed how some of these activities are reported on. The amalgamation of Economic Development and Trade with Technology, Research and Telecommunications, Tourism, Parks and Recreation and the Forestry Industry Development group from Forestry, Lands and Wildlife has brought together under one department the programs for industry development and manufacturing. The amalgamation of the remainder of Forestry, Lands and Wildlife into Environmental Protection will bring a new

approach to many of these programs. Other amalgamations include Occupational Health and Safety into the Department of Labour, Career Development and Employment into Advanced Education and Culture and Multiculturalism into Community Development.

The Alberta Government is involved in several initiatives which will also have an impact on the preparation of its R&D strategy. Each department and agency has prepared a three year business plan with an R&D plan and strategy for evaluation of their programs. The commitment of the Government as stated in "Seizing Opportunity" and "Budget '93" to improve management and coordination of research and development activities will provide additional impetus to many of these activities.

# 7

## FINDINGS

1. The investment in research and development (R&D) and related scientific activities (RSA) continues to drop, with an estimated drop of over \$11 million from 1993/94 to 1994/95. The S&T investment for 1994/95 is \$195.72 million (tables 7.1 and 7.2).

The drop in provincial R&D and RSA invested has contributed to a reduced growth of gross expenditures on research and development (GERD) in Alberta relative to the rest of Canada. Alberta's GERD at \$735 million in 1981 was 12% of Canada's GERD. In 1991 it has slipped to only 7% of Canada's GERD.

2. The reorganization and amalgamation of departments together with the financial restraint has resulted in reduction of research efforts in some important areas. Notably the research programs in Occupational Health and Safety, Museum Services and Palaeontological Research and Family Life and Substance Abuse are dramatically reduced or completely cut. These programs were relatively small, but the impact on the social well-being of Albertans will be felt in a negative way. A similar negative economic effect can also be expected.
3. The uncertainty in R&D funding and delays in approval of funding for projects is resulting in severe delays in a number of projects. Since many projects are cooperative projects with industry and other provincial or federal participants, delays in provincial funding jeopardize the entire project and the federal or industrial investment in the province.



**TABLE 7.1 1994/95 SCIENTIFIC ACTIVITIES BUDGET**  
(\$ millions)

Department/Agency	1991/92 Actual	1992/93 Actual	1993/94 Estimated	1994/95 Proposed
Alberta Agriculture, Food and Rural Development	13.85	14.44	17.21	19.38
Alberta Agricultural Research Institute	5.85	5.86	5.86	6.60
Alberta Energy	5.65	6.84	5.85	4.62
AOSTRA (now part of Alberta Energy)	25.29	19.99	15.80	19.90
Alberta Research Council	27.41	27.98	26.70	22.55
Alberta Environmental Protection <sup>2</sup>	48.50	50.24	48.15	36.61
Alberta Health	5.49	6.25	5.89	5.89
Alberta Labour	1.63	0.98	0.36	0.36
Alberta Heritage Foundation for Medical Research (AHFMR)	28.27	28.13	30.50	30.00
Alberta Economic Development & Tourism <sup>3</sup>	23.98	20.88	22.44	13.96
Alberta Transportation & Utilities	6.86	7.68	7.29	6.95
Alberta Community Development	21.65	20.92	15.52	14.78
Other Departments & Agencies	19.33	15.24	14.12 <sup>4</sup>	14.12 <sup>4</sup>
<b>TOTAL</b>	<b>233.76</b>	<b>225.42</b>	<b>215.69</b>	<b>195.75<sup>1</sup></b>

<sup>1</sup>Alberta Advanced Education and Career Development provides vital funding for operational and infrastructure support for R&D at Alberta Universities, estimated to be roughly \$189 million. Such contributions to infrastructure are not normally included in R&D investment statistics. Alberta Universities perform approximately one-third of the provincially funded R&D through grants and contracts from the departments and agencies.

<sup>2</sup>Includes certain activities that belonged to the Departments of Forestry, Lands and Wildlife and Tourism, Parks and Recreation.

<sup>3</sup>Includes certain activities that belonged to the Departments of Technology, Research and Telecommunications, Tourism, Parks and Recreation and Forestry, Lands and Wildlife.

**TABLE 7.2 1994/95 FUNDING BY ECONOMIC AND SOCIAL SECTOR**

	<b>R&amp;D</b>	<b>RSA (\$ million)</b>	<b>TOTAL</b>
<b>Agriculture and Food</b>			
Alberta Agricultural Research Institute	5.94	0.66	6.60
Alberta Agriculture, Food and Rural Development	10.17	9.21	19.38
Alberta Research Council	0.37	-	0.37
<b>Total</b>	<b>16.48</b>	<b>9.87</b>	<b>26.35</b>
<b>Petroleum and Gas</b>			
AOSTRA	18.26	1.24	19.50
Alberta Research Council	6.26	-	6.26
<b>Total</b>	<b>24.52</b>	<b>1.24</b>	<b>25.76</b>
<b>Coal</b>			
Alberta Energy	0.60	0.02	0.62
Alberta Research Council	0.70	-	0.70
<b>Total</b>	<b>1.30</b>	<b>0.02</b>	<b>1.32</b>
<b>Other Energy and Mineral</b>			
Alberta Energy	2.00	2.00	4.00
<b>Total</b>	<b>2.00</b>	<b>2.00</b>	<b>4.00</b>
<b>Forestry</b>			
Alberta Environmental Protection	0.67	0.75	1.42
Alberta Research Council	1.01	-	1.01
Economic Development and Tourism	1.40	-	1.40
<b>Total</b>	<b>3.08</b>	<b>0.75</b>	<b>3.83</b>
<b>Health Care and Medical</b>			
Alberta Health	4.51	1.38	5.89
Alberta Environmental Protection	-	0.49	0.49
Alberta Labour	0.25	0.11	0.36
Alberta Heritage Foundation for Medical Research	30.00	-	30.00
Alberta Research Council	2.01	-	2.01
Alberta Economic Development & Tourism	0.20	-	0.20
<b>Total</b>	<b>36.97</b>	<b>1.98</b>	<b>38.95</b>

**TABLE 7.2 1994/95 FUNDING BY ECONOMIC AND SOCIAL SECTOR**

	<b>R&amp;D</b>	<b>RSA</b> (\$ million)	<b>TOTAL</b>
<b>Manufacturing</b>			
Alberta Economic Development & Tourism	6.42	0.35	6.77
Alberta Research Council	4.76	-	4.76
<b>Total</b>	<b>11.18</b>	<b>0.35</b>	<b>11.53</b>
<b>Information Technologies</b>			
Alberta Research Council	4.55	-	4.55
Alberta Economic Development & Tourism	2.40		2.40
<b>Total</b>	<b>6.95</b>	<b>-</b>	<b>6.95</b>
<b>Transportation</b>			
Alberta Transportation & Utilities	1.06	5.89	6.95
Alberta Research Council	0.34	-	0.34
<b>Total</b>	<b>1.40</b>	<b>5.89</b>	<b>7.29</b>
<b>Environment</b>			
Alberta Environmental Protection	6.92	11.74	18.66
AOSTRA	0.40	-	0.40
Alberta Research Council	2.55	-	2.55
Economic Development and Tourism	-	0.34	0.34
<b>Total</b>	<b>9.87</b>	<b>12.08</b>	<b>21.95</b>
<b>Infrastructure &amp; Other</b>			
Alberta Community Development	-	14.78	14.78
Alberta Economic Development & Tourism	2.45	0.40	2.85
Alberta Environmental Protection	0.91	15.13	16.04
Other Departments & Agencies <sup>1</sup>	1.29	12.83	14.12
<b>Total</b>	<b>4.65</b>	<b>43.14</b>	<b>47.79</b>
<b>TOTAL</b>	<b>118.40</b>	<b>77.32</b>	<b>195.72</b>

<sup>1</sup> Estimated from 1993/94 investment.

<sup>2</sup> Alberta Advanced Education provides vital funding for operational and infrastructure support for R&D at Alberta Universities, estimated to be roughly \$184 million. Such contributions to infrastructure are not normally included in R&D investment statistics. Alberta Universities perform approximately one-third of the provincially funded R&D through grants and contracts from the departments and agencies.



# 8 1994/95 RESEARCH PROGRAM - BY ECONOMIC SECTOR

In these days of financial restraint and cutbacks it is important to analyze the distribution of funds used for all government activities. Research and scientific activities are important investment areas that are necessary to ensure ongoing development of our wealth generating activities and social welfare. Figure 8.1 shows the percentage contribution in the past decade to the Gross Provincial Product of the different economic sectors.

## Agriculture and Food

### **Major Participants**

- Alberta Agriculture, Food and Rural Development
- Alberta Agricultural Research Institute
- Alberta Research Council
- Alberta Environmental Protection
- Alberta Universities

The agriculture and food sector continues to be one of Alberta's major source of employment and income. The sector continues to be an important contributor to economic activity with the primary agricultural sector (excluding the related food processing and other manufacturing activities) growing by over \$500 million in contributions to the GPP and almost 15% employment growth since 1985. The investment in the development of new varieties of crops and animals has paid off in keeping Alberta's farmers competitive and increasingly productive. In 1992, total farm cash receipts from the sale of crops and livestock were estimated at \$4.87 billion, an increase of 16% over 1991.

Agriculture products including food and beverages accounted for over 10% of Alberta exports in 1991 and is expected to be over 15% in 1992.

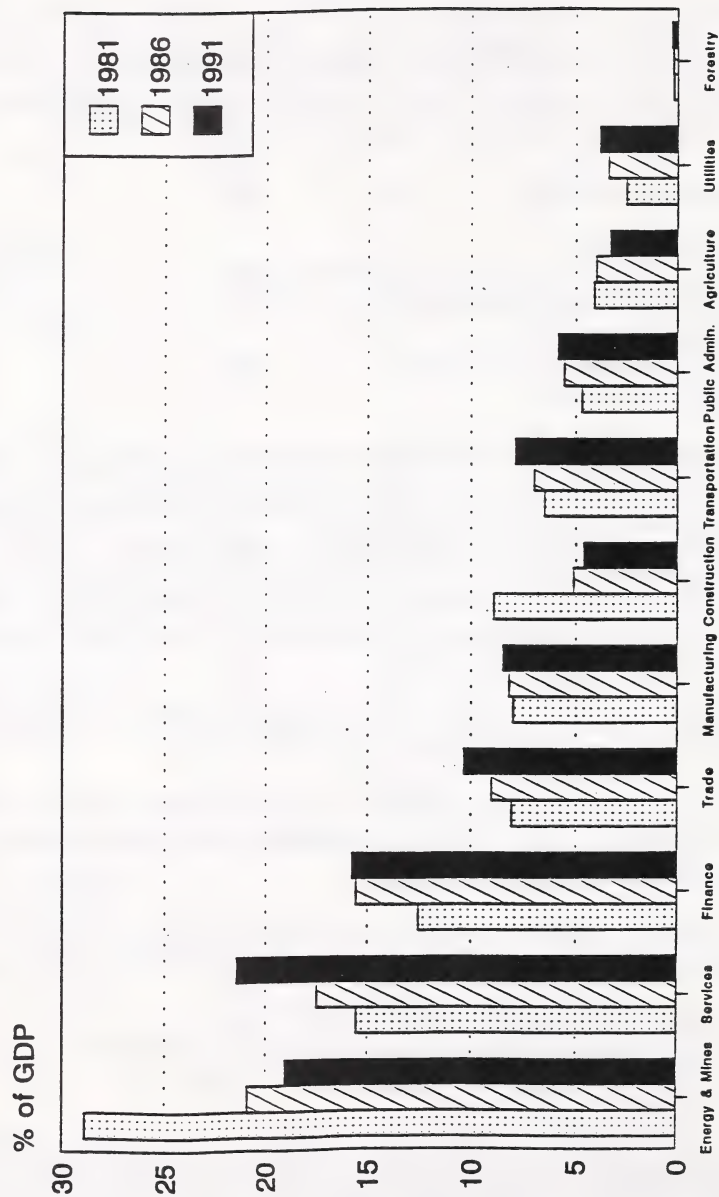
The total value of processed agricultural products continues to grow steadily and is estimated at \$4.9 billion in 1992. The food and beverage manufacturing sector in Alberta represents over 12% of provincial exports.

The agri-food industry is built on the results of science and technology. The 1994-95 provincial agri-food research program has a range of objectives, including:

- a) improved animal nutrition and productivity
- b) improved seepage control and land reclamation for irrigated soils
- c) increased farm machinery efficiency
- d) improved crop management
- e) strengthened and expanded food processing
- f) development and commercialization of innovative products of agricultural biotechnology
- g) demonstration of agricultural innovations in action in about 70 to 100 on-farm demonstration projects

Figure 8.1

# CONTRIBUTION TO PROVINCIAL GDP BY SECTORS



Agriculture - includes fishing & trapping

Forestry - excludes sawmills, pulp & paper mills which are in manufacturing

Trade - includes retail and wholesale trade

Alberta Agriculture, Food and Rural Development and the Alberta Agricultural Research Institute (AARI) are the leading funders of agricultural and food research and are the focus in the province for coordination and planning of the provincial investment in these research programs. Other provincial participants include Alberta Environment, the Alberta Research Council and the University of Alberta.

### **Energy and Other Minerals**

#### **Major Participants**

- Alberta Energy
- AOSTRA
- Alberta Research Council

#### ***Petroleum***

As conventional oil reserves decrease in Alberta and public attention to environmental concerns increase, technological developments become increasingly important to the energy and minerals industry in Alberta. With the economic realities of the past 6 or 7 years of low oil prices, the competitiveness of the Alberta industry can largely be attributed to the application of technological developments that occurred in the past two decades.

As conventional oil reserves decrease in Alberta, the relative importance of the four oil sands deposits increase. The major part of the Alberta Government research investment in this sector reflects this shift in priority. AOSTRA and the Alberta Research Council are the two major government bodies responsible for oil sands research with Alberta Energy and Alberta Environment activity involved in supporting research activities.

#### **Specific Objectives**

- (1) Demonstrate, in a commercial scale production pattern, the impressive results obtained for the Twin Well concept of steam assisted gravity drainage from underground access.
- (2) Extend the concept of steam assisted gravity drainage using twin wells to surface access wells with application in all three major oil sand deposits.
- (3) Demonstration of the ATP recovery technology for a mined oil sand application.
- (4) Development of technology which will substantially reduce the cost of conversion of bitumen to transportation fuels.
- (5) Maintain an ongoing effort in technology transfer, institutional research, information dissemination, and training.

#### ***Coal***

Alberta's coal industry continues to be an important energy source with production over 35 million tonnes annually. Its 12 major coal mines produce three types of coal for the domestic and export markets. Today's market conditions make it essential that producers use the most



efficient and economical technologies available in exploration, production, preparation, upgrading, transportation and marketing.

Alberta's coal industry will continue to supply the low-sulphur coal that makes electricity available to all Albertans at low cost and minimal environmental effects.

A key research objective is to develop clean coal-burning technologies for long-term, environmentally acceptable and safe use of coal as the fuel of choice for generating electricity.

Objectives for this year are:

- develop CO<sub>2</sub> capture technologies to enable the disposal or use of CO<sub>2</sub>
- Integrated Gasification Combined Cycle systems
- NO<sub>x</sub> control
- Full Fuel Cycle Emission Analysis
- determine effects of trace elements in coal on processes
- carbon fibres from coal
- on-line analyzers
- the suitability of Alberta coals for pulverized coal injection in blast furnaces

### *Hydrogen*

The presence of substantial amounts of hydrogen in Alberta's sour gas resources is a potential source that could allow recovery of hydrogen, which is a highly valued product that is being used increasingly in the energy industry.

Program objectives are:

- to develop technologies for producing, transporting and using hydrogen more efficiently to upgrade Alberta's energy resources and produce ammonia and methanol, and develop new uses for hydrogen

### *Alternative Energy*

Renewable solar and wind energy resources of southern Alberta show promise of being used on a large scale.

Program Objectives are:

- to develop and demonstrate technologies for exploiting Alberta's solar, wind and hydro resources

### *Other Minerals*

Alberta possesses numerous deposits of valuable minerals whose full commercial impact has not yet been identified and characterized. The development of all these non-renewable, renewable and non-energy resources can contribute enormously to the diversification and growth of Alberta's resource industry.

- A major objective is to further characterize and exploit Alberta's non-energy mineral resources and maintain an up-to-date geological data base and assessment of Alberta's earth resources.

## **Health Care**

### **Major Participants**

- Alberta Health
- Alberta Labour, Occupational Health and Safety
- Alberta Family Life and Substance Abuse Foundation
- Alberta Heritage Foundation for Medical Research(AHFMR)

AHFMR will support research programs to ensure that Albertans have access to first class health care. Other contributing departments and agencies include: Alberta Economic Development and Tourism, Alberta Foundation for Nursing Research, the Alberta Research Council and Alberta Environment.

The increasing cost of health care is receiving considerable attention. Programs are identified to address development of new and improved treatments to not only improve the health and productivity of Albertans but also to decrease the cost of treatment and care.

Key programs include:

- a) The development and evaluation of new methods of treatment of substance abuse.
- b) Clinical and basic research in areas such as heart disease and cancer.
- c) Basic, clinical and health service research on issues relevant to mental health with the objective of improving the mental health of Albertans.
- d) Explore causes of learning and attention disorders including genetics.
- e) A focus on health service outcomes in terms of effectiveness of health services.
- f) Basic and clinical research in heart attack therapy, transplantation of insulin - producing cells for diabetics, nerve regeneration, viral infections including hepatitis B and Chronic Fatigue Syndrome.
- g) Specialized care for Alzheimer's disease, lupus, etc.

## **Manufacturing**

### **Major Participants**

- Alberta Economic Development and Tourism
- Alberta Agriculture, Food and Rural Development
- Alberta Research Council

Alberta Economic Development and Alberta Research Council collaborate in a broad range of

## **Transportation and Utilities**

### **Major Participants**

- Alberta Transportation and Utilities
- Alberta Research Council
- Alberta Universities

Alberta Transportation and Utilities will carry out a variety of programs to improve the cost effectiveness of Alberta's transportation system. The programs focus on:

- improvement in the design, maintenance and operation of the highways, roads, bridges and airport
- in cooperation with Alberta Research Council and the universities long term research on the performance of pavement, bridge structures and hydraulics
- in cooperation with national and international agencies, research into asphalts, pavement performance, concrete structures, highway maintenance programs

## **Environment**

### **Major participants**

- Alberta Environment supported by many Alberta government departments and agencies

Alberta was the first province to establish a department of the environment (1917), and scientific studies commenced shortly thereafter. Many baseline studies have been completed, which have formed the framework to guide ongoing economic development.

The 1980s saw a large number of environmentally-related initiatives, by both the government and industry. A Clean Air Strategy was developed which helped set regulations and standards. The first hazardous waste management plant in North America was constructed at Swan Hills. Alberta became a leader in understanding the effects of acid rain, in land reclamation, the prediction of severe storms, in air quality prediction, and in the removal of sulphur from stack gases, to name just a few of many major accomplishments.

Key program elements include:

- toxicology studies on natural and man made substances
- restoration of disturbed, degraded or contaminated lands
- protection of plant and animals from pests and diseases
- development of sound waste management strategies
- preservation and enhancement of the quality of Alberta's water resources
- provision of analytical and diagnostic environmental services

Environmental concerns are one of the major impediments to growth of our economy. Alberta's environmental research programs will provide the basic scientific data to ensure optimum development of our social and economic resources.



optimum development of our social and economic resources.

### **Research Infrastructure**

- All departments and agencies support research infrastructure in their areas of responsibilities.
- Such infrastructure is sector specific, costly and beyond the reach of most companies.
- Industry normally provides considerable financial and technical support.

Examples include:

- Alberta Environmental Protection
- Alberta Environmental Centre
- Alberta Agriculture, Food and Rural Development
- Research Facilities such as The Food Processing Development Centre
- Alberta Energy and Renewable Energy Facilities
- Alberta Oil Sands Technology and Research Authority
- Major Field Pilots, Underground Test Facility
- Alberta Research Council
- Biotechnology Pilot Plant, Electronics Test Centre, Wood Products Test Facility
- Alberta Heritage Foundation for Medical Research
- Two major medical research facilities, the Alberta Universities Research facilities
- Alberta Economic Development and Tourism
- Various advanced technology institutes, such as TRILabs, The Laser Institute, Alberta MicroElectronics Centre
- Alberta Culture and Multiculturalism - Royal Tyrrell Museum, Reynolds Museum,
- Alberta Advanced Education
- The Alberta Universities Research Facilities

# 9

## 1994/95 RESEARCH PROGRAMS - BY DEPARTMENT AND AGENCY

In this section of the report, the research strategies, goals and programs are outlined for each department and agency. Each organization provided a written document describing their 1994/95 technology plans. The task group then met with representatives of the organization to seek additional clarification and to obtain missing information.

### 9.1 ALBERTA ADVANCED EDUCATION AND CAREER DEVELOPMENT

#### 9.1.1 Background

The development of Alberta during the last three decades was greatly helped by the contribution made by the post-secondary education system. The province has a highly educated labour force which is quick to adapt new skills.

Graduates of Alberta's universities, technical institutes and colleges provide the knowledge and skills required by a modern economy. Basic or fundamental research performed at Alberta universities adds to the general stock of knowledge on which social, economic, and scientific/technical progress is made. The performance of basic research is also critical to the training of highly qualified workers.

Alberta's universities are major performers of research and development funded directly through grants and contracts by the province (just over \$36 million in 1991-92). The province also benefits from the research conducted at Alberta's universities funded by federal government sources (approximately \$70 million in 1991-92). Research conducted at the universities helps provide the knowledge required to help ensure the long term viability of the province's major industries whether through the application of knowledge to natural resource industries such as energy, forestry or agriculture, in the emerging medical and biological fields, or in the various high technology areas.

NAIT, SAIT and the public colleges educate the technologists and technicians required by industry. Human resource development through advanced education and training is increasingly recognized as central to economic performance and competitiveness whether in research-related or other areas of our economy.

#### 9.1.2 Department Objectives

To provide post-secondary and labour market support services and programs to Albertans to meet current and anticipated social and economic needs.

To provide basic infrastructure support for Alberta's post-secondary institutions through the provision of annual operating and capital grants.

To achieve an appropriate balance in the teaching and research functions of Alberta's universities, recognizing the importance of each function to Alberta's social and economic well-being and the synergy between these functions.

To continue to educate and train the next generation of a highly qualified labour force, including scientists and engineers, to enhance Alberta's competitive position in the new global economy.

To continue to support fundamental research at Alberta universities with a view to reinforcing excellence and building on strength.

### **9.1.3 Investment Level**

In 1993-94, the department provided over \$460 million in operating support and approximately \$15 million in capital 'formula-funding' support to Alberta's three residential universities. Of this amount, the department estimates that approximately \$184 million in operating support and \$5 million in capital support will be devoted by the universities to support research.

It is estimated that in 1993-94, close to \$150 million will be received by Alberta's three residential universities in support of sponsored research. (In 1991-92, the most recent year for which audited figures are available, the comparable income figure was over \$143 million). Sponsored research funding at Alberta's residential universities increased 330% between the years 1979-80 to 1991-92, from just over \$32 million to over \$140 million. Most recent data indicates that the University of Alberta and The University of Calgary rank fourth and eight respectively among Canadian universities in terms of level of sponsored research funding received.

Alberta universities continue to command an increasing proportion of federal peer-reviewed awards from the three research granting councils. For example, federal granting council funding to Alberta universities increased by approximately 37% over a three year period alone (between 1988-89 and 1991-92), growing from approximately \$44.9 million to approximately \$61.5 million. During the same time period, provincial funding decreased by approximately 27% from approximately \$49.1 million to approximately \$36 million.

### **9.1.4 Priority Concern - Capital Equipment Funding**

The universities' level of capital renewal funding has dropped from approximately \$38 million in 1984-85 to approximately \$15 million in 1993-94.

The low level of funding provided is of great concern. It is the main source of funding available to the universities to repair and upgrade buildings and building spaces (including labs); maintain, upgrade, and replace furnishings and equipment; and execute site maintenance. It is probably reasonable to assume that approximately 1/3 of these funds are available for research equipment repair, maintenance, upgrading and replacement. That translates to approximately \$5 million per year available to the three universities. This funding is clearly inadequate to maintain the viability of the physical research infrastructure.



Capital equipment funding is a major concern to the universities and to the department. Work is in progress to address this issue and consultations have been held with the institutions but without additional funding the problems of disrepair and obsolescence will escalate.

#### **9.1.5 Organizations Involved**

The Department provides operating and capital grants to all of Alberta's universities, technical institutes and colleges. Hence, the department contributes the main source of funds for faculty salaries, buildings, laboratory equipment and space, libraries, support staff and maintenance.

Alberta Advanced Education and Career Development represents the Alberta government at inter-department, inter-agency and inter-jurisdiction forums involving higher education issues. As well, the department is represented in the Technology and Research Advisory Committee, the Deputy Minister's Committee on Research and Development and the Alberta Agricultural Research Institute.

#### **9.1.6 Expected Impact**

Alberta's post-secondary education systems will continue to contribute towards the economic development of Alberta through:

- educating the next generation of scientists, engineers and technicians
- updating the skills and expertise of existing employees
- performing research on behalf of and in collaboration with Alberta industry
- transferring research results to the private sector for commercial development
- ensuring Alberta's participation in national high quality research initiatives, such as the Networks of Centres of Excellence Program, in collaboration with institutions of other provinces
- acting as a source of new companies "spun off" from the universities
- linking Alberta to the national and international research community, and helping Alberta to remain in touch with new research and knowledge.

## **9.2 ALBERTA AGRICULTURE, FOOD AND RURAL DEVELOPMENT**

### **9.2.1. Introduction**

Agriculture is important to Alberta and research is important to agriculture. The agriculture and food industries in the province are multi billion dollar industries. They produce high quality, safe and nutritious food products. Primary production is conducted on about 57,245 farms spread out across 51.4 million acres of land. The food processing industry employs a substantial portion of Alberta's work force. An estimated 30% of Alberta's labour force is employed directly or indirectly in the food industry. The agriculture and food industry as a whole generates income and employment for thousands of Albertans. In 1992, total direct revenue from sales of commodities and processed food products was estimated at \$9.8 billion.

It is in the best interest of all Albertans to continue to make the large amount of natural, human and financial resources invested in agriculture even more efficient and profitable than they presently are. Agri-food research is fundamental to this pursuit. Research allows producers and processors involved in the agri-food industry to utilize Alberta's land and water resources as efficiently as possible to produce crops, livestock and processed food products that meet consumer demand (Figure 9.2.1).

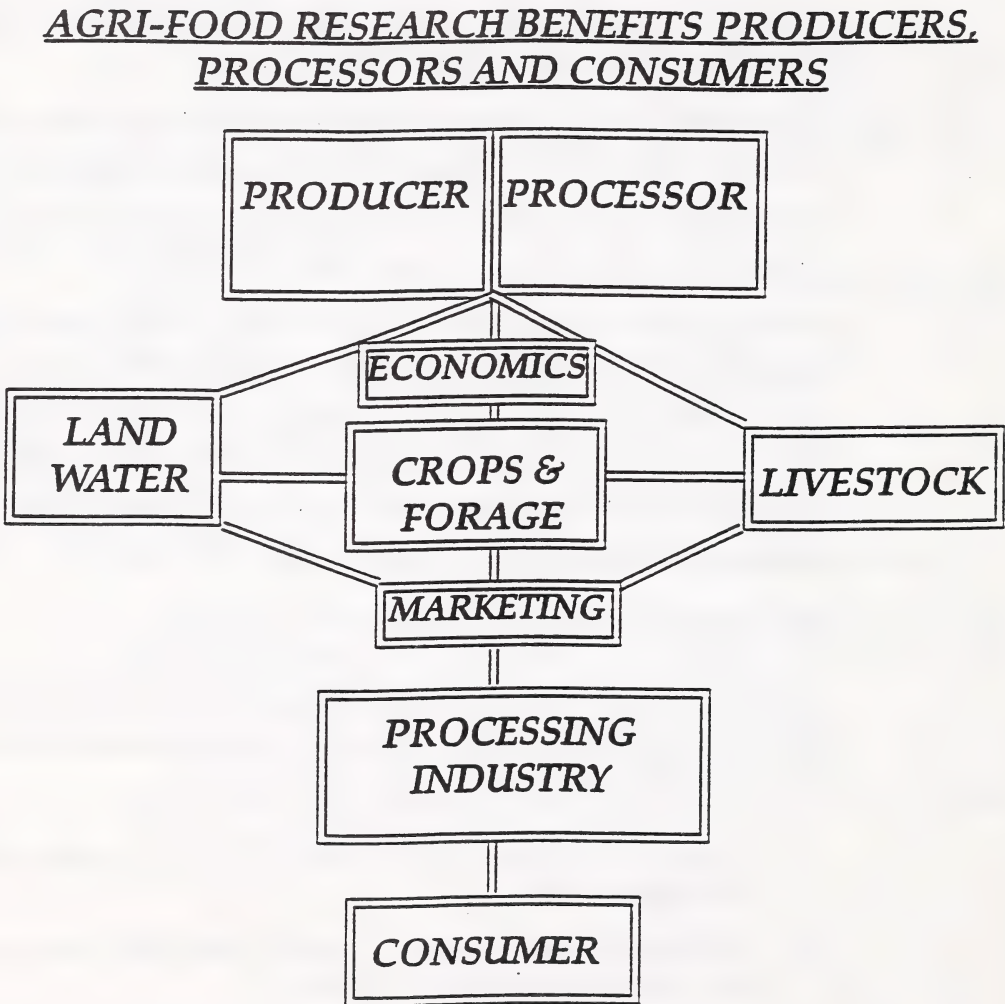
Effective application of past research results has led to substantial improvements in agricultural productivity and food processing. Successfully applied research results include: improved crop varieties, improved breeds of livestock, new food processing methods, scientifically proven production techniques and improved management approaches. In all these areas, Alberta producers and processors have benefited from agricultural research and have proven to be good adopters of new technology appropriate for the agro-climatic conditions under which they operate. Research has been and will continue to be one of the most important tools for improving Alberta's continued competitiveness in the international market.

### **9.2.2. Mission**

Alberta Agriculture, Food and Rural Development's mission is to ensure the existence of policies and services which support the sustainable growth and development of a market driven agriculture and food industry. The department has established a set of goals to more effectively pursue it's mission. These goals are:

1. To improve the industry's ability to access and respond to domestic and world market opportunities.
2. To increase the industry's ability to diversify and add value to the commodities it produces and the products it manufactures.
3. To develop information and technology that improves industry competitiveness.

Figure 9.2.1 AGRI-FOOD RESEARCH BENEFITS PRODUCERS, PROCESSORS AND CONSUMERS





4. To ensure the industry has access to needed technology, knowledge and skills.
5. To strengthen the industry's capability to manage risk and uncertainty.
6. To ensure responsible stewardship of the soil and water resources used by the industry.
7. To ensure that public lands that are the responsibility of the Ministry are managed for the long-term benefit of the industry and the public.
8. To manage the Ministry's financial and human resources and legislated responsibilities efficiently and effectively for the benefit of the industry and the public.

### **9.2.3 The Role Of Research Within Alberta Agriculture, Food And Rural Development**

The department views research as a vital means to achieving its mission. Technology development is one of the few avenues open to Alberta for improving the marketability of agricultural products and enhancing the production efficiency and competitiveness of Alberta producers. Therefore, a vigorous research program is one of the most important activities undertaken by the department as the world moves towards a more open global economy at the turn of the century.

The department's primary role in the research field is to conduct, fund or facilitate research of particular benefit to Alberta producers and processors. The department concentrates on those technologies that give Alberta enterprises unique commercial advantages. Producers, processors and researchers must work together to efficiently utilize the province's natural resources, and present high quality crops, forages and livestock to the province's food processing industry. The processing industry transforms raw agricultural commodities into highly valuable consumer products. The benefits of agricultural research are realized by consumers when nutritious, quality processed foods are made available to them at reasonable prices (Figure 9.2.1).

The department carries out its research role by conducting, funding or facilitating agriculture and food research. As one of many organizations involved in agri-food research, the department works closely with producers, processors and other provincial and national organizations. Working with the agri-food industry makes department staff aware of industry problems, technological needs and research priorities. Maintaining close contacts with other agricultural research organizations helps to ensure that the department's research effort is coordinated with the research activities of other organizations. The sharing of information that results from broader contacts paves the way for Alberta farmers and processors to learn about and benefit from provincial, national and international advances in agricultural technology.

Although applied and adaptive research will be emphasised, the department may be involved in basic and developmental research if they are necessary to meet the industry's research needs. It is also the department's desire to challenge its staff to carry out original, curiosity

driven and innovative research that has the potential to create novel products or revolutionary solutions to problems faced by producers, processors and agri-business.

#### **9.2.4 Technology Transfer To Industry**

New scientific information and technology developed through research must be effectively transferred to producers, processors and agri-business if the benefits of research are to be realized by society. It is therefore necessary to have a strong link between research and technology transfer.

Alberta Agriculture, Food and Rural Development has traditionally placed a special emphasis on transferring the results of research to its clients. Technology transfer to primary producers is conducted mainly through the department's sixty-six district offices located across the province. The district agriculturists and home economists located in the district offices are supported by regional specialists working out of the six regional centres (Lethbridge, Airdrie, Red Deer, Vermilion, Barrhead and Fairview). Professional staff working in the eight divisions located in Edmonton and in the various research facilities are also heavily involved in transferring technology either directly to primary producers or through the regional.

Technology transfer to the food processing industry is conducted through the Processing Services Division of the department. Division staff located in Edmonton and at the Food Processing Development Centre at Leduc provide province-wide services in this area.

The department uses several approaches in disseminating technical information to producers and processors and agri-business. These approaches include publications, demonstration projects, home study courses, direct client contacts, meetings, conferences, radio and television broadcasts and a computer bulletin board system. It is important to note that the universities, agricultural colleges, the federal research stations, producer and processor organizations and private sector firms are also engaged in technology transfer activities to varying degrees.

#### **9.2.5 Research Programs For 1994-95 And Accomplishments In The Past Year**

Alberta Agriculture, Food and Rural Development will continue to support research in agricultural production, processing and related areas. As shown in Figure 9.2.1, the department's research emphasis will include land and water resources, crop development, livestock development, food processing, and economics and marketing studies.

The department's research efforts are aimed at solving industry problems or developing innovative technology that can be applied by the agri-food industry. As the Department changes to provide more specialized knowledge, resources are being re-directed to support more applied research. The diverse nature of the agri-food industry and the varied environmental conditions under which they operate require this type of broad-ranging research to ensure the continued competitiveness and profitability of the industry. Brief descriptions of the department's research efforts in the various areas are presented below:

## **A. Soil and Water Resources Research**

Studies pertaining to irrigation as well as soil and water conservation are conducted by the Irrigation and Resource Management Division. The programs in the division are focused on promoting the stewardship of agricultural soil and water resources to sustain the productive capability of Alberta's natural resources. Programs are also directed at developing primary producers' skills and knowledge with respect to soil and water management.

Irrigation programs are aimed at developing and promoting the adoption of on-farm irrigation and drainage management and development technology. Major program areas include: irrigation capital works evaluation and monitoring, irrigation projects system planning, on-farm irrigation and drainage development planning and irrigation feasibility and planning.

Programs under the Land Evaluation and Reclamation Branch focus on land evaluation, seepage control and land reclamation for irrigated lands in order to conserve and sustain the productive capacity of soil and water resources. Major program areas include: salinity identification, control and reclamation, land classification for irrigation purposes, surface and subsurface water quality monitoring, canal seepage control, ground water flow evaluation and irrigation impact assessments.

The Conservation and Development Branch develops and promotes the adoption of dryland soil and water conservation technology. The branch works closely with municipalities and agricultural organizations. Major program areas include wind and water erosion control, conservation cropping and tillage, dryland salinity control, conservation planning, soil inventory, agricultural climate and weather analysis, water quality monitoring and surface water management.

### *Major Accomplishments In Soil and Water Resources Research:*

- Irrigation programs to develop and promote the adoption of on-farm irrigation and drainage technology.
- Sustainable cropping studies to document and monitor crop rotation and tillage practices across Alberta.
- Analytical services to test and diagnose soil nutrient deficiencies and water quality evaluation were made available to farmers.
- Studies to trace the migration of nitrates in groundwater were continued.
- Irrigation management practices were evaluated to determine the best irrigation schedules for maximum crop production.
- An on-farm water management study to evaluate an alternative to uncontrolled drainage and evaluate habitat for wildlife.



## **B. Agricultural Engineering Research**

A number of applied research projects are conducted by the Agricultural Engineering Branch with the goal of increasing farm machinery efficiency and improvement and performance of farm structures. Projects include tractor fuel efficiency, grain harvesting, grain drying, dugout construction and computer applications on the farm.

The Alberta Farm Machinery Research Centre in Lethbridge conducts tests and evaluations on various types of agricultural machinery and equipment. It assists in the design, development and use of agricultural machines. Projects and programs are conducted to identify effects of various types and makes of equipment on production and net farm return. Farmers' concerns about new and used machines are used in program development. Typical projects include: mechanization to suit new cropping methods, safety and performance standards, improving machinery efficiency and machinery systems to increase farm income.

The centre also maintains contact with equipment manufacturers and coordinates its projects with similar centres in other prairie provinces. This coordination allows for transfer of results, information and services. Programs and test procedures are standardized to permit accurate comparisons of information and results.

### *Major Accomplishments in Agricultural Engineering Research:*

- Engineering solutions to crop production systems including seeding, spraying, tillage, and harvesting were implemented.
- Departmental engineering expertise was utilized for intensive livestock housing, manure management and odour control systems to improve efficiency, address environmental issues and increase profitability.

## **C. Crop Development Research**

Most of the crop development related research in the department is conducted by the Plant Industry Division. The Division conducts "applied and developmental" research directed towards production efficiency and crop diversification as well as improved crop management systems. Crops including field crops, horticultural crops, special crops, greenhouse crops and forages are investigated from all production parameters, including soils, crop protection, product quality and irrigation management. Increasingly, factors pertaining to environmental sustainability are included in research design and programs.

In the Plant Industry Division research is directed at problem solving. It takes current worldwide "agro-technology", reviews, modifies and tests its applicability to Alberta conditions and consequently is able to provide "expert advice" to producers and other clients. Multi-disciplinary research aimed toward improved crop management systems is emphasised.

The division manages research facilities within each of its five branches. These facilities represent all geographic areas of the province and have allowed the division to embark upon a number of activities conducted within the Plant Industry Division are given below:

- i. The Alberta Special Crops and Horticultural Research Centre (ASCHRC) at Brooks is involved in province-wide research activities relating to all areas of horticulture and irrigated specialty crops. Programs are focused on the improvement of management practices. Variety testing is an important aspect of most production programs. Emphasis on crop diversification includes new crop development of herbs and spices, alternate greenhouse crops and small fruits. Cold hardiness research is conducted on herbaceous perennials and woody ornamentals. In addition, the centre conducts research in post-harvest physiology to support the Prairie Potato Breeding Program. Under the food processing quality evaluation program, small fruits and special crops are evaluated for processing and quality factors.
- ii. At the Alberta Tree Nursery and Horticultural Centre at Oliver, research programs are focused in nursery, vegetable, seed potato, greenhouse and tissue culturing. The micropropagation pathology program provides disease testing and research support for the seed potato and tissue culturing programs.
- iii. The Field Crops Development Centre is located at Lacombe, Alberta. The Centre's mandate is to develop improved varieties of feed grains with emphasis on feed barley. Programs are also conducted on spring and winter triticale and winter wheat for central and northern regions of Alberta. All research programs are supported by agronomy studies to develop information on variety development.

In the spring barley program, the emphasis is on the production of high yielding feed type 2 and 6-row cultivars of both the hulled and hullless type. Special emphasis is being placed on transferring the semi-dwarf characteristic into the 2-row germplasm base.

- iv. In the Soil and Crop Management Branch, research is conducted to deal with crop production problems and improved crop management systems. The objectives of the research are to calibrate and evaluate soil tests for predicting fertilizer requirements and to determine the need for cost effective crop production inputs. Crop production systems that result in maximum economic yield and efficient use of inputs are being developed.

Research activities relating to the improvement of solonchic, luvisolic, organic and acid soils are also conducted. Crop response to deep ploughing and ploughing and ripping and the application of lime and phosphogypsum to solonchic soils are being evaluated. Also, crop response to rates and forms of lime to acid soils and crop response to ripping luvisolic soils are being monitored.

Research on organic soils include the use of soil test procedures and their interpretations, fertility requirements and an assessment of deep plowing.

Research programs in the Soil and Crop Management Branch are also aimed at developing weed and pest management strategies, improved weed and pest management decision making practices and reduced environmental impacts of weeds and pest management practices. Research activities include weed and pest

monitoring to prevent spread or establishment, chemical, cultural, biological and integrated control measures.

- v. The Soils and Animal Nutrition Laboratory in Edmonton provides analytical services to researchers, extension staff and producers. Diagnostic services in weed and pests are now available from a combination of private labs, Alberta Agriculture, Food and Rural Development labs and Alberta Environmental laboratories at Brooks, Fairview and Vegreville respectively. Alberta Agriculture, Food and Rural Development staff also conduct efficient extension and advisory functions to producers. The Soils and Animal Nutrition Laboratory provides, in addition to diagnostic service, research analysis to public and private agency researchers for projects directed toward the improvement of crop and animal production.

*Major Accomplishments in Crop Development Research:*

- Significant advancements in nutritional status of feed grains were realized through development of barley cultivars. Licensing of new hulless varieties of barley is:
  - 1) creating a significant advantage for Alberta's livestock industry;
  - 2) finding new interest in its value as a human food in Pacific Asia markets; and
  - 3) offering an opportunity to reduce nitrates in livestock waste management systems because of higher digestibility of nutrients.
- New developments in effective biological control methods for control of pests in field crops and greenhouses; control of several weed species in pastures and annual crops plus the development of management systems using bio-control thrips in greenhouses are among initial successes in this very diverse area.
- Micronutrient deficiency is an area of soil and crop management emerging as a major cause of poor crop nutrition and low crop yield. Research in this area has identified several million acres in the province exhibiting the deficiency to varying degrees. Complex interactions in terms of crop stress, disease, herbicide and fertilizer response are being assessed as well as diagnostic methods to help assess when a problem exists.
- The increased use of winter cereals has both environmental and economic advantages. New varieties of winter triticale and emerging new lines of winter wheats are providing the varied agro-climatic region of the province with more drought hardy, cold tolerant winter cereals for both forage and cereal uses. Maintaining ground cover over late winter and early spring is an excellent secondary benefit.
- Diversification of Alberta's crop base was enhanced through development of new and improved varieties and crop management systems of horticulture and specialty crops including nursery crops, vegetable, seed potato, greenhouse crops, herbaceous perennials and woody ornamentals.



- Techniques to improve the agricultural productivity of solonchetic, luvisolic, organic and acid soils in Alberta were released.
- New weed and pest management strategies were introduced to reduce crop losses and lessen the environmental impact of weed and pest management practices.
- Weed and pest diagnostic services were made available to farmers and private agency researchers.
- Environmental and resource impact of commercial agricultural practices were assessed and approaches to enhance our agricultural resource base are continuously pursued as an integral part of research activities focused on production efficiency and competitiveness.

#### **D. Livestock Industry Development**

Alberta Agriculture, Food and Rural Development's livestock research programs are directed to animal agriculture at the producer level. The animals and facilities of cooperating livestock producers are extensively used and the department cooperates/collaborates with a number of public and private sector organizations to meet its research objectives. Research programs in livestock include nutrition, health, breeding and management studies. Applied and demonstration research projects are conducted throughout Alberta by departmental livestock specialists.

Research projects are associated and supported by several laboratory operations. The animal nutrition laboratory located in Edmonton provides analytical services for livestock feeds. It is also involved in ruminant feed evaluation in cooperation with the University of Alberta.

The Animal Health Laboratories Branch, through its facilities in Edmonton, Airdrie, Lethbridge and Fairview, provides diagnostic services to livestock producers and animal owners throughout the province and for disease research and disease surveillance purposes. This service assists animal owners and their veterinarians in establishing the cause of death and production losses in the animals under their care. In addition, the branch serves as a consulting and referral agency on matters of animal disease and its prevention and conducts an applied research and investigation program. Analytical and testing services are conducted in the specialized disciplines of bacteriology, virology-serology, toxicology and electron microscopy-histology to identify a wide range of disease-causing organisms, toxins and nutritional deficiencies. The services of the laboratories are provided to Alberta livestock and poultry producers and their veterinarians, other institutions and to the rural and urban public.

The Health Management Branch conducts applied research projects which minimize or prevent animal diseases and promote management techniques that enhance the health and productivity of animals.

In a broader sense, the research conducted in the Animal Industry Division include studies in nutrition, health, physiology and management so as to increase overall

productivity and market competitiveness, taking into account welfare issues and product quality. The research activities include traditional livestock and more recently game and exotic species. Extensive surveys are carried out periodically so as to quantify the status of an industry, study the progress and identify extension and other needs which would impact on farm income and productivity.

The division does not own animals or a farm facility for the purpose of conducting research but all research is conducted in collaboration with producers, regional staff, agriculture staff from other divisions, Agriculture Canada, the Universities of Alberta and Saskatchewan, VIDO, producer associations, applied research facilities and private sector agri-business organizations.

The purpose is to conduct research that would accomplish three key aspects:

1. Social benefits
2. Savings and reduction of unit costs of production
3. Productivity Improvement

#### *Societal Benefits*

Projects include the evaluation of new methods of animal identification, welfare issues, biting fly control studies, mastitis research, development of eggs containing omega-3 fatty acids, research into the development of the beef herd management reference binder, the herd health and nutrition binder, software development such as COWCHIPS and COWBITES. In addition, two extensive surveys were undertaken in dairy and beef which identified strengths and weaknesses in the two industries.

#### *Savings and Reduction of Costs*

Many nutrition studies on pasture, in feedlot and the laboratory (NIR) were conducted to impact on reducing the feed costs in production as recommended alternate feeds and feeding systems. These include studies on triticale as an alternative to barley feeding, peas to replace soybeans in dairy diets, effects of feeding supplemental protein and fat, and studies on utilizing and feeding high moisture barley. Research was conducted on the efficacy of different vaccines (IBR, BVD and RSV) and on the use of anthelmintics for nematode control in grazing cattle. Studies were conducted on the effect of disease status on the performance of bulls in ROP test stations and many studies were conducted testing out new insecticides. A number of studies on dystocia identified threshold effects between calf birth weight and dystocia. Pelvic area per unit of body weight was identified as a useful selection criteria for dystocia reduction in heifers.

#### *Productivity Improvement*

Research on the advantages of early weaning, preconditioning, spaying using the Willis drop method and implanting spayed heifers to obtain a synergistic effect in growth rate have been performed. Reliability studies with expected progeny differences and the many feeding trials conducted have contributed to the development of the livestock industry in the province.

### *Major Accomplishments in Livestock Development Research:*

- New methods of minimising production costs in beef and sheep, suggesting alternative management strategies, and increasing production efficiency.
- Optimizing reproductive efficiency and minimising calving difficulty by altering animal management practices.
- Research that recommends alternate management practices that are complementary with better animal welfare.
- Continued research in animal nutrition, pasture production, health and reproduction of beef and dairy cattle, sheep, swine, poultry, horses and elk.
- Analytical services to evaluate feeds, identify deficiencies, make recommendations to improve the nutritional quality of rations and herd production diagnostic software development.
- Diagnostic services provided with useful information for disease prevention, disease monitoring, quality control (immunology and serology) services to standardize performance in private laboratories and development of culture media to enhance mastitis control on dairy farms.

### **E. Food Processing Research**

Food processing research and technology transfer are conducted at the Food Processing Development Centre (FPDC) located in Leduc. The Food Processing Development Centre is primarily a technology transfer facility designed to strengthen and expand the capability of Alberta's food processors to meet the challenges of the marketplace. Food processors can, through the application of new technology or research, develop new or improved products and processes.

Research at the Centre is in support of or in cooperation with other researchers. The Centre undertakes research projects in product development, prototype design, shelf-life and product stability testing for small and medium sized companies. Technical assistance, consultations and demonstrations of new technologies and utilization of specialized equipment are also provided to Alberta's food and feed producers.

### *Major Accomplishments in Food Processing Research:*

- The department supported an initiative to replace imported soybean meal with Alberta grown peas, hullless barley and canola meal for animal feed rations.
- A value-added processed potato product containing meat was developed for test market evaluation in Japan.
- Fibrinogen, a protein extruded from an animal by-product was developed as a bonding agent in meat processing. This process has led to the establishment of F.N.A. Foods Inc. in Alberta.



- Extrusion processing has been developed and utilized to pre-cook peas and beans for use as an ingredient in processed foods.

## **F. Food Quality and Safety Research**

Alberta Agriculture, Food and Rural Development has a food laboratory located in Edmonton. The laboratory's mandate is to provide analytical, scientific and technical services to the agriculture and food industry to ensure that the safety and quality of the food supply is maintained and enhanced. Microbiological testing conducted in the laboratory involves identification of the numbers and types of microorganisms present in foods, detection of pathogens in food ingredients and processing environments and detection of antibiotic residues. Chemical analysis ranges from compositional and nutritional analyses, to testing for biocide residues and other food contaminants. Special projects are carried out on new analytical procedures as well as on adaptation and modification of existing methodology. The central milk testing laboratory carries out the analysis for the producer-processor payment program and for Alberta's Dairy Herd Improvement program. Laboratory staff provide advisory extension services to food processors, producers, exporters and other government agencies.

Laboratory staff also conduct applied research either as the principal research group or in collaboration with researchers in other organizations. The research conducted by the laboratory staff falls in one of the following four general areas:

### **i. Support to government or university researchers.**

This support is generally in the form of analytical testing and/or supplying data collected as part of regular programs. The analyses requested in some instances may require specialized or automated equipment.

### **ii. Current scientific topics as a result of laboratory testing surveys.**

### **iii. Collaborative studies with other laboratories to verify analytical methodology.**

### **iv. Modification and development of analytical methods.**

#### ***Major Accomplishments in Food Quality and Safety Research:***

- New products were developed with a longer shelf-life and environmentally friendly packaging to increase marketability.
- Milk quality improved in the province as a result of regulatory, research and extension efforts of the department.
- Food quality and safety research ensured that the safety and quality of the food supply is maintained and enhanced.

## **G. Economic Research**

The Economic Services Division of the department places high emphasis on economic, financial, taxation, legal, and marketing research issues relating to agriculture.

Economics and marketing studies permeates all agricultural activities ranging from new land and irrigation development to the production and processing of crops and livestock. The division provides applied economic services in commodity marketing and extension, production cost research and data analysis, legal information and advice and farm management services. Clientele groups include farmers, government departments and agencies, farm organizations and the private sector servicing the agricultural industry.

The Farm Business Management Branch develops and adopts farm management technology for use by farm families in making business decisions. Information is delivered through special programs, conferences, publications and the media.

The Market Analysis Branch provides farmers and other members of the agricultural sector with timely and pertinent market-related information on which to base production and marketing decisions. The branch monitors and analyses agricultural commodity and product markets, prepares market situation and outlook reports, interprets policy and other developments related to agricultural markets. The branch works closely with department staff and farm organizations in providing producers with a thorough understanding of the function of the market and information on innovative marketing techniques.

The Production Economics Branch undertakes economic research on the costs, returns and profitability of all commercially viable crops and livestock produced in Alberta. The branch provides this information to farm clients to reduce production costs, and increase the economic efficiency and competitiveness of Alberta farms. The branch works closely with irrigation and resource management division to conduct research related to the economics of farm conservation practices and sustainable agriculture and the on-farm economics benefits and costs of water management projects. Research is also done in support of policy insurance, National Tripartite Stabilization Program, Gross Revenue Insurance Program and Net Income Stabilization Account.

#### *Major Accomplishments in Economic Research:*

- Useful information was made available to producers on production economics, farm finance and agricultural policy.
- Analysis pertaining to supply and demand of agricultural commodities, market trends, global competitiveness, trade policy and buyer/consumer preferences were conducted.

#### **H. Marketing Research**

The Marketing Services Division of Alberta Agriculture, Food and Rural Development conducts or arranges for research in the analysis and identification of specific market opportunities in Canada and abroad. Studies relating to niche market access strategies are done by consulting firms hired by the Marketing Services Division, or more appropriately by private sector companies, often with assistance or guidance from the department. Research on specific commodities is aimed at having better market information for industry development and for strengthening the industry's marketing capabilities either as individual companies or for the industry as a whole. Division resources are being reallocated to increase effort in marketing intelligence and opportunity research.

Alberta Agriculture, Food and Rural Development's marketing efforts are aimed at identifying and developing value-added food product markets in the U.S., Japan and other countries through a cooperative government/industry endeavour.

#### *Major Accomplishments in Marketing Research:*

- The international marketing program of Alberta Agriculture, Food and Rural Development focused on the promotion of higher value food, beverage and feed products.
- Research results enabled farmers to determine how well they are performing relative to other producers and are encouraged to make the necessary changes to reduce input costs and/or increase output from existing farm resources.

#### **9.2.6 The Level Of Cooperation On Programs**

Recognizing that there are other parties - private sector organizations, academic institutions, the federal government and provincial government agencies that have significant capability for agricultural research, the department has established collaborative research linkages with these research agencies. Cooperative research with other organizations has enabled the department to have access to research facilities and expertise that are not available within the department. As a result, it is able to get a much broader range of research work done that benefits the agri-food industry than would have been possible if the research work was confined to the department's own facilities.

The department provides grants for a number of research programs from its line budgets. In 1993-94, the department spent an estimated \$1,983,969 from its line budget in support of research in other organizations (Table 9.2.1). The research activities supported range from poultry production at the University of Alberta, to agricultural engineering at the Alberta Research Council.

Recently, producers in the various parts of the province have shown a strong interest in funding or conducting applied research through producer organized associations. To recognize and promote such self-help, innovative and potentially rewarding ventures among producers, the department has established a program to assist applied research associations with core funding. Under the program guidelines, associations have to meet certain specific criteria and show successful operation for at least five years.

Providing funds to other organizations in support of research helps to strengthen the research capabilities of the recipient organizations. The total effect of the department's research funding programs has been to expand and intensify the knowledge base of the province's agriculture and food industry and accelerate technology transfer.

#### **9.2.7 Budget Estimate**

The estimated provincial investment for 1994-95 in agri-food research and related scientific activities by Alberta Agriculture, Food and Rural Development is over \$19 million. Table 9.2.2 provides a detailed breakdown of the anticipated investment.



**TABLE 9.2.1**  
**ALBERTA AGRICULTURE, FOOD AND RURAL DEVELOPMENT**  
**ESTIMATED 1993-94 BUDGET FOR RESEARCH CONDUCTED IN**  
**COLLABORATION WITH**  
**OTHER AGENCIES, UNIVERSITIES OR INDUSTRY BY PROGRAM<sup>1,2,3</sup>**

PROGRAM	RESEARCH AGENCIES	1993-94 BUDGET ESTIMATE
Poultry Research Centre	University of Alberta	185,000
New Crop Variety Testing	University of Alberta Agriculture Canada Alberta Environment	790,969
Livestock Collaborative Research Projects	University of Alberta Private Sector Agencies	80,000
Agricultural Engineering Research	Alberta Research Council Agriculture Canada University of Alberta Canadian Standards Association	28,000
Laboratory Analytical Service for Soils Research	University of Alberta Agriculture Canada Private Industry	500,000
Applied Research Operation	Applied Research Associations	400,000
<b>Total</b>		<b><u>\$1,983,969</u></b>

<sup>1</sup> Other research funding bodies also contribute funds to support scientific activities in the above research agencies.

<sup>2</sup> Approximately 60% of the budget allocated by Alberta Agriculture for collaborative work with other agencies goes toward manpower.

<sup>3</sup> The funds listed above are used to support collaborative work.

**TABLE 9.2.2**

**ALBERTA AGRICULTURE, FOOD AND RURAL DEVELOPMENT  
ESTIMATED 1994-95 BUDGET FOR RESEARCH & DEVELOPMENT  
AND RELATED SCIENTIFIC ACTIVITIES**

<u>Estimated Divisional Research Budget</u>	<u>1994-95 Fiscal Year</u>	
	<u>Budget Estimate</u>	
<u>Divisions</u>	<u>R&amp;D</u>	<u>RSA</u>
Animal Industry	265,000	512,000
Economic Services	684,000	171,000
Field Services Sector	528,000	1,971,000
Irrigation and Resource Management	585,000	585,000
Processing Services Sector	1,264,000	1,206,626
Planning Secretariat		150,000
Marketing Services	1,090,000	1,090,000
Plant Industry	5,749,230	3,095,739
Research	<u>10,165,230<sup>1</sup></u>	<u>440,862</u> <u>9,222,227<sup>2</sup></u>
<b>Grand Total of <sup>1 &amp; 2</sup></b>		<b><u>\$19,387,457</u></b>

### **9.2.8 Planning Process Used To Establish Programs**

The planning process for establishing major new programs involves an extensive procedure (Figure 9.2.2). First, the problem to be investigated is identified through consultations with industry and external advisory committees. Once the problem is defined, a literature survey is conducted and input is obtained from the private sector, university and government research organizations.

Following the consolidation and analysis of the collected information, a detailed research plan is developed. Further input is collected from the appropriate industry sector, government agencies, and research organizations before the plan and the budget request are submitted for final decision. The final plan is then forwarded to the Minister, and through him to the appropriate governmental body for final approval and budget commitment.

The approved plan is implemented by departmental researchers as soon as funds and other required resources become available to launch the program.

Research projects within an established program generally go through detailed planning and reviews similar to major programs. However, the decision level required does not normally go beyond senior management within the department. External inputs from industry and other research organizations are received as part of project planning. Each project is also subjected to annual evaluations during reviews.

### **9.2.9 Processes In Place For Program Coordination With Other Departments, Federal Departments And Industry**

The primary responsibility for coordinating specific research programs of Alberta Agriculture, Food and Rural Development with those of other public and private sector organizations rests with the researcher in charge of the program and the branch and division managers. The researcher is the person who clearly understands the scientific basis of the program and its relationship to other similar programs in the province. As an officer of the department and a responsible scientist in his or her profession, the researcher is expected to ensure that his work does not duplicate the work of other scientists but rather adds to and expands the stock of knowledge.

The branch and division managers are accountable for the proper management and coordination of the research programs under their direction. They can obtain the necessary advice from the specific researcher in charge, or from existing advisory committees. They can also create new ad hoc committees to examine coordination or other issues relating to the research programs under their control. Following the normal channels, they can make or recommend program changes or adjustments. Major program changes may require Executive Committee, Deputy Minister and/or Ministerial approval.



Past experience suggests that department researchers are well aware of research conducted at federal, provincial, academic and private sector organizations in their field. Various formal and informal reviews have also indicated that the department's research programs are well coordinated with, and complement those of other departments, federal research stations, universities and private sector organizations.

Department researchers, branch heads, division directors and senior department officials are also in constant contact with officers of federal, provincial, academic and private sector organizations, and attend various provincial and national committee meetings. Special consultative bilateral meetings are also held with relevant organizations, such as the Research Branch of Agriculture Canada, the Alberta Barley Commission, etc., to exchange information on programs and harmonize policies. As a result, coordination of agricultural research programs had not been an issue in Alberta.

The Alberta Agricultural Research Institute also plays an important role in the coordination of agricultural research in the province. Through its extensive Board of Directors and committee structure which involves key individuals from the private sector, academic institutions and government agencies, AARI fosters effective coordination of agri-food research in the province.

## **9.2.10 Evaluation Procedures Used To Determine Effectiveness Of Programs**

Evaluation of research programs is conducted at two levels. The first level involves evaluating the impact of research results on industry productivity sustainability and efficiency. The second level involves the internal research reviews and assessments of performance, productivity and achievement relative to research objectives.

The contribution of a specific research program to industry productivity is conducted at appropriate intervals. The evaluation is done by external consultants, outside advisory committees or ad hoc committees specifically created to carry out the needed program evaluations.

Internally, research programs and activities are subjected to peer reviews. As well, program managers regularly evaluate the research functions of staff, and often in considerable detail during the annual budget review process and as part of the annual staff performance appraisal.

## **9.2.11 Research Areas That Could Or Should Be Expanded Or Added To The Program**

The following areas have been identified for enhancement or expansion in the department's research plan:

1. Research that will lead to greater diversification of agricultural production in response to market demand and to help expand the value-added sector.

Figure 9.2.2 AAFRD Planning To Establish Major Research Programs

## **ALBERTA AGRICULTURE, FOOD AND RURAL DEVELOPMENT**

### **PLANNING TO ESTABLISH MAJOR RESEARCH PROGRAMS**



2. Research into the processing of agricultural products, new product development, new packaging techniques, as well as the further enhancement of the safety, quality and nutritional value of agricultural products.

3. Integration of economic and environmental sustainability factors into research programs as necessary.



## **9.3 ALBERTA AGRICULTURAL RESEARCH INSTITUTE**

### **9.3.1 Introduction**

The Alberta Agricultural Research Institute (AARI) is a provincial Crown corporation. It is governed by a board of directors and appointed by the Minister of Agriculture, Food and Rural Development. The Institute plays an important role in Alberta's agricultural research effort. Its primary purposes are to coordinate and support agricultural research programs that are of benefit to the agri-food industry and technology development.

To facilitate strong linkages and coordination among agricultural research organizations, the make-up of the Institute's Board was purposely designed to include representatives of Alberta Agriculture, Food and Rural Development, Agriculture Canada, other relevant provincial departments, universities and the private sector. The broad contacts maintained by the Institute help to promote a team spirit among organizations engaged in agri-food research and development.

### **9.3.2 Objectives**

The objectives of the Alberta Agricultural Research Institute for the next five years will be to:

1. Strengthen coordination
2. Financially support research in:
  - agricultural marketing
  - agricultural processing
  - agricultural production and
  - soil and water conservation
3. Transfer technology to the agri-food industry through:
  - Department specialists
  - demonstrations
  - direct computer access to research results and
  - publications.

The Institute funds are available to researchers in the public and private sectors through open, competitive grants. Appropriate project review mechanisms involving farmers, researchers and Alberta Agriculture staff have been established to ensure that the projects selected for funding complement existing efforts of Alberta Agriculture and other organizations.

Through well managed competitive grants the Institute will:

1. Identify and support high priority research projects that are not being adequately funded through existing organizations
2. Encourage the private sector to invest in research by providing matching grants
3. Allow fuller utilization of the research infrastructure and highly skilled agricultural researchers within the province, and
4. Accelerate the completion of research projects.

### **9.3.3 Research Programs For 1994-95**

The Alberta Agricultural Research Institute administers seven research assistance programs: the Farming for the Future Research Program, the Matching Grants Program, the Research Coordination Program, the National Agricultural Biotechnology Initiative, the Farming for the Future On-Farm Demonstration Program the Externally Funded Research Program and the Information Dissemination Program. In 1994-95 funds will be re-allocated to increase support for the Matching Grants program. The Scientific Conference Assistance Program and the Research Professorship Program will be phased out. Also, a strong marketing effort will be launched, starting in 1994/95, to "sell" the program of AARI and the research capabilities of Alberta Agriculture, Food and Rural Development.

#### **1) Farming for the Future Research Program:**

The Farming for the Future Research Program is financially supported by the Alberta Heritage Savings Trust Fund. The purpose of the program is to finance agricultural research which benefits primary producers and food processors. The projects that are supported within the Research Program are chosen on the basis of several criteria, including their ability to enhance the competitiveness, profitability and sustainability of Alberta's agri-food industry. In 1993-94, 99 research projects were funded at a total investment of approximately \$3.9 million.

#### **2) The Matching Grants Program:**

Under the Matching Grants Program, the Institute matches, on a 50:50 basis, contributions from the private sector and other eligible sources. The Matching Grants Program is primarily intended to attract financial contributions from the private sector. In 1993-94, the Institute provided matching funds for 64 research projects for an investment of approximately \$1.5 million.

#### **3) The Research Co-ordination Program:**

The Research Coordination Program is designed to provide financial support for scientists involved in agriculture and food research. The assistance is being provided to promote coordination and communication among researchers involved in similar

work or interdisciplinary research. Five Research Coordination projects were supported in 1993-94.

**4) The National Agricultural Biotechnology Initiative:**

The purpose of the National Agricultural Biotechnology Initiative (NABI) is to support the development and commercialization of innovative products of agricultural biotechnology. Projects are eligible after genetically engineered plants, animals or other organisms have shown characteristics that are potentially marketable, or a new method has been successful. Currently, four projects, two relating to crop production and two to animal production are supported. Starting in 1994-95, project funding under NABI will be managed as part of the Matching Grants Program.

**5) On-Farm Demonstration Program:**

The On-Farm Demonstration Program provides financial assistance for projects that demonstrate technology of benefit to Alberta producers and agricultural processors. Under this program, farmers, department staff, and research scientists work together to demonstrate agricultural innovations in action. About 70 to 100 demonstration projects are supported annually.

**6) Externally Funded Research Program:**

Under this program, AARI administers research funds received from private organizations or public sector funding agencies for specified research projects.

**7) Information Dissemination Program:**

The purpose of this program is to distribute the results of AARI supported projects to Alberta Agriculture, Food and Rural Development specialists, extension staff and all potential users. The information is distributed through project reports, articles, publications and by electronic means.

**9.3.4 Major Accomplishments In The Past Year**

In the fiscal year 1992-93, the Alberta Agricultural Research Institute received 197 final reports which present the findings of completed research projects and demonstrations. Many noteworthy findings were reported by the researchers and specialists involved in the research and demonstrations funded by AARI. Research was conducted in the areas of: agricultural marketing; agricultural processing; resource conservation and sustainable development; and agricultural production. Some of the results reported were as follows:

- *Economic Feasibility of International Trade in Feedgrains or Feeder Cattle Between Alberta and the Northwestern U.S.A.*
- Based on models reflecting prices and production during the mid to late 1980s, results indicated that feedgrain trade between Alberta and the northwestern United States was feasible. Specifically, Alberta as a major producer of barley, could



potentially serve a nearby market deficient in feedgrain. The viability of this market is largely dependent on barley prices, exchange rates and barley production costs in Alberta. The study also examined the potential movement of livestock to the northwestern U.S. The model results suggested that Alberta's livestock sector could benefit as a result.

- *Development of Specific Probes for an Important Oil Formation Enzyme in Canola*
  - Genetic manipulation of the enzyme which catalyses canola oil formation was the basis of this study. Significant advances were made in isolation of the enzyme and development of an immunological probe for its detection, laying the groundwork for genetic manipulation of the enzyme. This technique could result in higher oil producing canola varieties in the future.
- *The Disinfection of Honey Bee Equipment and Hive Products Using Gamma Radiation*
  - This study found that cobalt-60 gamma irradiation of hive equipment heavily contaminated with the American foulbrood organism was completely effective in comparison to the control, which was 84% infected after six weeks. The irradiation treatment, however, was not effective against sacbrood disease. Commercial gamma irradiation of equipment is now available to beekeepers. It offers an advantage over antibiotic treatment. The irradiation treatment does not leave a residue.
- *Safflower Management for Optimizing Yield and Quality*
  - Planting date studies have shown that yield and quality of the safflower crop seeded after May 15 was often at risk from fall frost. Planting is thus recommended from the last week of April or the first two weeks of May. Variable results were observed from desiccation to hasten harvest. Yields, oil levels, and test weights were commonly reduced if safflower was not completely mature when desiccated. It is recommended that a seeding rate of at least 34 kg/ha be used. Data from herbicide trials from this project, and other trials conducted by Agriculture Canada resulted in the first herbicides being registered for use on safflower in Canada. Trifluralin (e.g. Treflan and Rival) and Ethalfluralin (e.g. Edge) are registered as pre-plant incorporated wide-spectrum herbicides. Sethoxydim (e.g. Poast) has been tested and determined to be an effective post-emergent herbicide against grassy weeds and volunteer cereals in safflower.
- *Improvement of Barley Feed Quality in Alberta*
  - Barley (*Hordeum vulgare* L.) grown at Bentley, Alberta, was part of a national study "Improvement of Feed Quality in Barley" utilizing 73 of the Canadian registered varieties of barley. The field trials were conducted at Charlottetown (PEI), Ottawa (ON), Brandon (MB), and Bentley (AB) in 1991 and the quality analyses are being conducted in eastern Canada. The complete study is being

repeated in 1992. The data collected in Bentley in 1991, along with the data collected in 1992, allowed comparison of a large number of barley varieties (including eastern and western) for production in Alberta. Grain samples provided data with which to further define feed quality and identify specific factors required to meet eastern Canadian markets. The study illustrated where advantages are for western varieties, barley produced in Alberta, and where improvements could be made to enhance or maintain Alberta's competitiveness.

- *Evaluation and Development of Soft White Spring Wheats for Western Canada*

- Two new soft white spring wheat cultivars "SWS-52" and "AC Reed" developed at Lethbridge are quickly replacing commonly used U.S. cultivars. SWS-52 has a higher grain yield potential than the U.S. varieties, combined with resistance to stripe rust, and moderate resistance to black point and bunt. It also has good resistance to lodging and moderate resistance to shattering. Baking quality tests proved the variety suitable for flatbread, which made it acceptable for the export market in the middle east. SWS-52 was commercially produced for the first time in 1991. AC Reed proved to have a higher yield potential than the U.S. varieties, combined with early maturity, resistance to stripe rust, and moderate resistance to powdery mildew, common root rot, shattering and sprouting. It is equal to or better than the U.S. varieties in overall milling and cookie baking qualities. AC Reed will be available for commercial production in 1994. These two varieties are the first ever developed soft white wheat varieties in Canada.

- *Annual Legume Plowdown to Replace A Cultivated Fallow*

- Four major soil and climate zones were chosen for the experiment and five crops (Tangier Flatpea, field pea, red clover, sweet clover, and lentils) were compared for green manuring for growing barley. Green manuring was compared to summer fallowing. Red clover was the least suited annual legume for green manuring and Sirius pea was the best. The percent legume-nitrogen available to the barley crop was relatively constant at 10 to 20% with the rest remaining in the soil. Annual green manuring is beneficial or equal to summerfallow in reducing the requirement for nitrogen fertilizer in areas where adequate precipitation occurs. The economic cost of annual legume green manuring compared to a conventional cultivated fallow would appear to be quite similar. The additional input costs (seed, inoculant etc) are largely offset by the value of the nitrogen added to the soil.

- *Streptococcus suis: Spread and control of a new disease in Western Canadian swine*

- Nasal mucous samples were taken from 331 clinically healthy weaned piglets in 17 herds from Western Canada and *Streptococcus suis* was cultured from 96 piglets on 14 farms, showing a prevalence of infection of 29% of pigs. Fewer isolates were esculin positive and more were B-galactosidase positive compared to a former study. All strains were resistant to clindamycin, but were susceptible to deftiofur and tiamulin antibiotics.

- *Energetic efficiency of Wapiti*

- Wapiti offered a pellet containing alfalfa and barley with a marker, chromic oxide, was used to estimate feed intake and was compared to actual weighed intake; and on pasture, to the bite-count method and was considered suitable for estimating energy balance of free-ranging farmed wapiti. Daily maintenance requirements of young wapiti held in pens ranged from 500 kJ/kg in winter/spring to 725 kJ/kg in summer. On spring and summer pastures, these increased to 900-998 kJ/kg. Energy requirements for gain were not noticeably different between pen and field trials but were significantly lower in winter (25kJ/g) than in spring or summer (40kJ/g). The group of weaned stags fed a high energy ration were 20 kg heavier than a group fed a low energy diet, but by late July each group were equal in weight. The subsequent catch-up growth was due mainly to increased dry matter intake by the low energy group.

### 9.3.5 Cooperation In Implementing Research Programs

Many of the research projects funded by AARI are conducted cooperatively by researchers from different organizations. AARI also provides financial assistance to researchers to foster greater cooperation and coordination of research projects. The assistance facilitates joint planning of inter-disciplinary research and the exchange of data among the scientists involved strengthens cooperation.

On the technology transfer side, a considerable amount of cooperation between AARI, Alberta Agriculture, Food and Rural Development Staff and producers occurs during on-farm demonstrations. The Farming for the Future On-Farm Demonstration program was designed to accelerate the transfer of new technology to producers. Many producers cooperate with AARI to show new technologies to their neighbours. They donate a great deal of their equipment, time and effort to demonstrate how the new technology fits in with their particular farming operation. With the cooperation of producers from around the province, the On-Farm Demonstration Program has been very successful and popular with Alberta farmers. In 1992-93, 94 farmers participated in demonstration projects. The number of producers cooperating with Farming for the Future's on-farm demonstrations is expected to be about the same for 1993-94 and 1994-95.

In summary, a wide range of private sector organizations, academic institutions and government agencies cooperate in implementing research projects supported by the Alberta Agricultural Research Institute.

Table 9.3.1 shows the total funds awarded to research institutions in western Canada to carry out the approved research projects of the Farming for the Future Program, the Matching Grants Program, the Research Coordination Program and the Research Professorship Program in 1993-94. Although the amounts would vary, a similar number of organizations are expected to be cooperating with the AARI in 1994-95.



**TABLE 9.3.1 Alberta Agricultural Research Institute**  
**FARMING FOR THE FUTURE, MATCHING GRANTS, RESEARCH COORDINATION PROGRAM AND THE RESEARCH PROFESSORSHIP PROGRAM**  
**RESEARCH PROJECTS BY PERFORMING INSTITUTION AND RESEARCH PROGRAM AREA**  
**1993-94**

Research Program Area	Alberta Agriculture	Agriculture Canada	Alberta Environment	Private Industry	University of Alberta	Other University	VIDO <sup>1</sup>	WCVM <sup>2</sup>	TOTAL FUNDS
Beef and Dairy	-	477,820	-	153,000	420,000	10,000	254,000	122,000	1,436,820
Cereals and Oilseeds	150,000	853,284	116,500	-	242,088	160,562	-	-	1,522,434
Forage, Pulse, Vegetable & Other Crops	154,260	649,955	67,500	5,000	141,317	-	-	-	1,018,032
Pork, Poultry, Sheep & Other Livestock	44,400	91,070	-	-	576,813	30,000	97,025	200,210	1,039,518
Policy Economics & Marketing	-	28,000	-	32,700	145,320	-	-	-	206,020
Resource Conservation	111,900	175,760	-	3,525	179,285	17,630	-	-	488,100
<b>TOTAL</b>	<b>460,560</b>	<b>2,275,889</b>	<b>184,000</b>	<b>194,225</b>	<b>1,704,823</b>	<b>218,192</b>	<b>351,025</b>	<b>322,210</b>	<b>5,710,924<sup>3</sup></b>

<sup>1</sup>VIDO - Veterinary Infectious Disease Organization

<sup>2</sup>WCVM - Western College of Veterinary Medicine

<sup>3</sup>The figures include the provincial allocation for 1993-94 plus contributions from other sources.

### 9.3.6 AARI Budget Estimate

#### 1. Program Funding

The AARI's 1994-95 R & D budget is estimated at approximately \$6.60 million. Table 9.3.2 below provides a detailed breakdown of the anticipated investment.

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**TABLE 9.3.2**

**ALBERTA AGRICULTURAL RESEARCH INSTITUTE  
1994-95 BUDGET ESTIMATE FOR RESEARCH AND RELATED  
SCIENTIFIC ACTIVITIES**

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PROGRAM	1994-95
Research:	
Research Funding	\$5,250,000
(Matching Grants & Farming for the Future)	
Other Programs	265,000
Technology Transfer:	
On-Farm Demonstration Program and Research Information Transfer	660,000
Institute Administration	<u>425,000</u>
<b>TOTAL</b>	<b>6,660,000</b>

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### 9.3.7 Planning Process Used To Establish Programs

The Alberta Agricultural Research Institute has developed a five-year (1992-1997) Strategic Plan. The plan was developed through consultations with appropriate private sector, university and government representatives.

Starting in 1994-95, AARI introduced a single Strategic Committee that is responsible for examining and recommending future directions. This committee replaces the previous four strategic committees which dealt with the broad agricultural research strategic areas of 1) production, 2)processing, 3)marketing and 4)sustainable development and conservation. The Strategic Committee assists in developing AARI's strategic plans with input from private and public sector representatives. The Board, with its broad

membership, also brings both private sector and research community input to bear on the planning process.

Individual research proposals are developed by the applicants for funding. AARI influences the planning process by releasing research priorities in advance and selecting projects that are aligned with its long-term direction.

### **9.3.8 Processes In Place For Program Coordination With Other Departments, Federal Departments And Industry**

One of the most important responsibilities of the AARI Board is to ensure research coordination wherever possible. Many of the Board's efforts have been undertaken specifically in response to that goal.

Coordination starts with the Board's membership structure, which is designed to assist both the process of promoting and coordinating agricultural research among performers and users. For instance, having leaders of the province's major agricultural research organizations on the Board enhances agricultural research coordination among those groups. The federal department of Agriculture, the University of Alberta, the University of Calgary, Alberta Advanced Education, the Western College of Veterinary Medicine and private sector organizations are represented on the Board.

During previous years, the Board examined research activities by visiting and touring the major agricultural research facilities in Alberta. The tours and the discussions held with researchers from various institutions provided background information needed for Board members to assess the existing level of coordination and to identify areas that require improvement.

AARI also uses a formal reviews of ongoing research programs in Alberta as a way of encouraging coordination. These reviews started in September 1989 and two reviews are conducted annually. The reviews are undertaken by commodity and discipline areas, with the intention that all major commodity areas will undergo a review every three years. Participants typically include representatives from all institutions active in the particular research topic, and representatives from producer and processor groups who have a stake in the development of new knowledge and technology in their areas of interest. The exchange of research information during the reviews strengthens cooperation and coordination of scientific efforts among agricultural researchers in the province.

Further, AARI has established a Research Coordination Program. The Program is designed to provide scientists involved in agricultural research with financial support in order to promote research coordination. Through the program, networking, cooperation and exchange of information among researchers is promoted.

### **9.3.9 Evaluation Procedures Used To Determine Effectiveness Of Programs**

AARI's evaluation procedures involve two stages - research proposal evaluation and program evaluation. The Institute has established committees in six commodity/resource



areas to evaluate research proposals. The six research committees consist of producers, specialists and scientists. They conduct peer reviews and evaluate the economic and scientific merits of the proposals.

Research proposals are submitted by November 1 of each year. This allows time for a structured evaluation of approximately two months in duration. After evaluating the submissions, each of the committees forward their recommendations to the AARI Board for review and final approval. The Board meets in February to make final project selection. All approved projects are then awarded funds on a fiscal year basis beginning each April.

Funding decisions under the On-Farm Demonstration Program go through a different evaluation process. Applications must be submitted by agricultural producers or producer organizations to a regional committee (one for each agricultural region), comprised of producers and Alberta Agriculture, Food and Rural Development personnel. Producers form a majority on these committees. The committees recommendations are forwarded to the Institute for final consideration.

Program evaluations are conducted somewhat differently from project evaluations. AARI hires outside consultants to evaluate programs at appropriate intervals. The effectiveness of the Farming for the Future Program in serving Alberta's agri-food economy was reviewed in 1992. AARI hired an Edmonton management consulting firm called Serecon to conduct an economic evaluation of a sample of the projects funded under the Farming for the Future Program. Serecon evaluated the economic benefits of ten research projects and ten on-farm demonstration projects. The company estimated a direct economic return to the Alberta Economy of \$455.6 million over the next 15 years from these 20 projects alone. The amount invested in the 20 projects was \$7.24 million. The rate of return calculated by Serecon suggests that every dollar invested in these projects will yield over \$60 dollars to the overall provincial economy.

The Strategic Committee of the AARI also have a role in program evaluation. The committee reviews the effectiveness and direction of programs and recommend changes where necessary. If required, the AARI Board can also strike ad hoc committees to evaluate programs.

### **9.3.10 Research Areas That Could Or Should Be Expanded Or Added To The Program**

After consultations with representatives of both the private and public sectors, the AARI Board has identified three important research areas that should have intensified scientific effort directed to them:

- stronger emphasis on agricultural marketing,
- agricultural processing, and
- resource conservation/sustainable development.

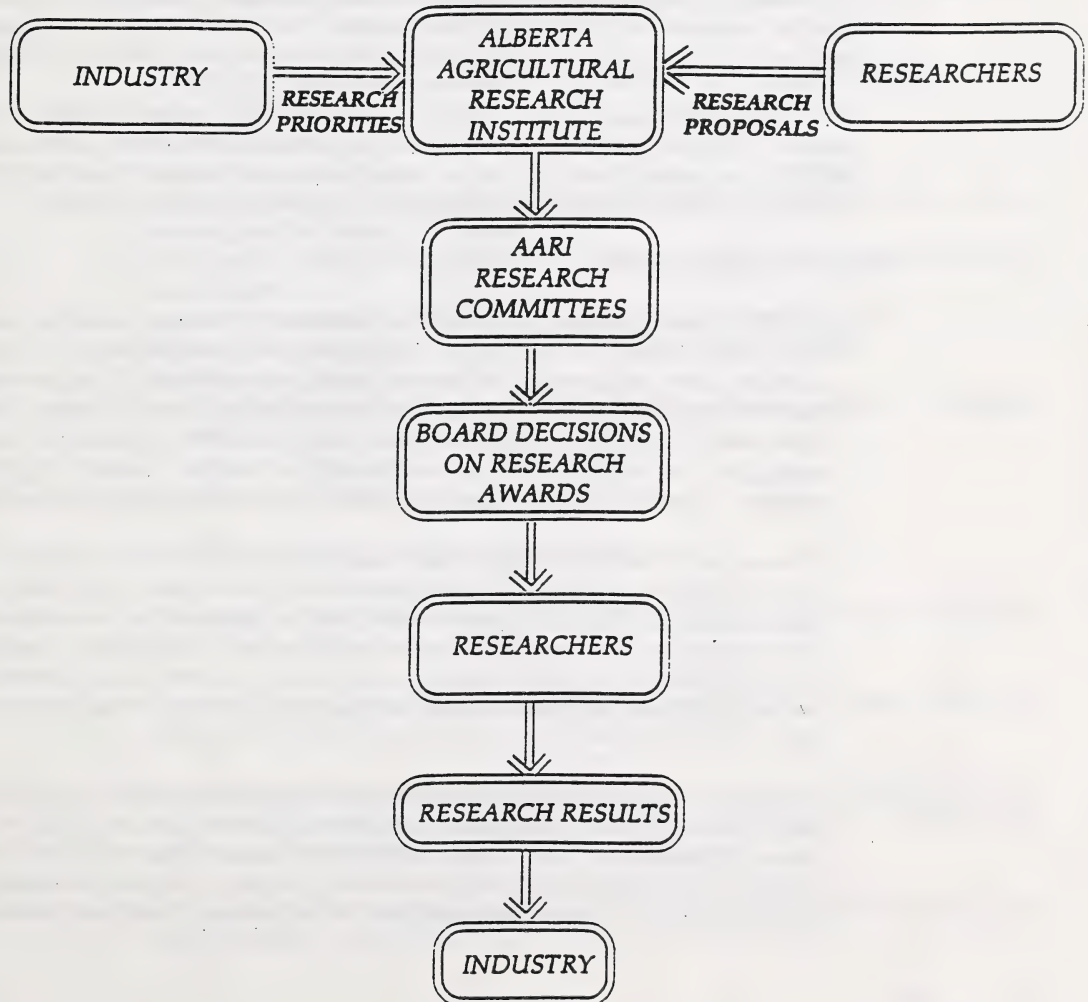
Research needs and priorities of the agri-food industry are regularly reviewed by the AARI Board and committees and adjustments are made to programs as needed.

Figure 9.3.1

## ALBERTA AGRICULTURAL RESEARCH INSTITUTE

### REVIEW PROCESS FOR PROJECTS

ISSUES  
PROBLEMS  
& PRIORITIES



## 9.4 ALBERTA HERITAGE FOUNDATION FOR MEDICAL RESEARCH (AHFMR)

### 9.4.1 Background

AHFMR was established by an Act of the Alberta Legislature in 1979. Its mandate was unequivocal: To establish and support a balanced, long-term program of medical research based in Alberta, and directed toward the discovery of new knowledge and the application of that new knowledge to improve the health of Albertans and all people.

AHFMR was given an initial endowment of \$300 million to be assessed for its adequacy after six years. Operations are funded from some of the investment earnings of the endowment to ensure that the fund remains intact. The Foundation was designed to be at arms-length from the government. It is run by a Board of Trustees with representatives from the universities, the medical profession and the general community. The Scientific Advisory Council advises on policy and major funding thrusts to ensure activities supported are of the highest standards. In addition, every six years an International Board of Review assesses the productivity and effectiveness of AHFMR.

The 1993 International Review Board, a group of world renown medical experts, assessed AHFMR and gave it an honours report card. The board acknowledged AHFMR has made Alberta one of the leading centres for medical research in North America and that our researchers can hold their own with the best in the world.

### *AHFMR Achievements*

- 1) AHFMR researchers have earned international acclaim for their pioneering work in areas such as: heart attack therapy, transplantation of insulin-producing cells for diabetics, nerve regeneration, cholesterol studies, the cell biology and genetics of cancer, drugs for viral infections including hepatitis B and Chronic Fatigue Syndrome, electrical therapy for paralysed people, vaccine development for malaria, meningitis, and diabetes, improved understanding of arthritis, causes of high blood pressure, diagnostic tests for ulcers, lupus, knee injury, cancer, and other conditions.

These advances and others are directed at more effective, earlier care to prevent long term problems so costly to well-being and the health care system. For example, the hepatitis drug has the potential to prevent costly complications and save millions of lives world-wide. Last year 158 Albertans were diagnosed with Hepatitis B and some 250,000 Canadians are now infected by the virus. The incidence of Hepatitis B infection in Canada has risen steadily, increasing more than 2.5 times in the past 10 years.

When islet transplantation becomes further refined and widespread, it may prevent or halt juvenile diabetes for hundreds of thousands of Canadians who are at risk for heart disease, blindness and other complications of the disease. Some 250,000 Albertans presently have insulin dependent diabetes that is costing \$195 million annually for insulin treatment. This cost does not include cost resulting from complications and



the associated personal and social costs resulting from the disease.

A fractional reduction in the costs attributable to only these two diseases would more than offset the costs of the whole program.

- 2) AHFMR researchers have made Alberta a leading medical care centre in the world. They have established specialized patient care clinics for Alzheimer's disease, lupus, joint injuries, diabetes, thyroid disorders, cancer, heart disease, multiple sclerosis, hearing disorders, neonatal medicine, and other conditions.
- 3) For every AHFMR dollar invested, medical researchers now attract two additional dollars in external funding from public and industry sources. These dollars would not have come to Alberta without AHFMR investment.
- 4) Innovations coming out of Heritage medical research labs have become the basis for new companies. The AHFMR Technology Commercialization Program aids this process and also supports innovators in industry.
- 5) AHFMR has supported more than 3000 research training positions for young people.

#### *1992-93 Highlights*

- 18 new investigators recruited to Alberta, including a top AIDS researcher and one working on light therapy for cancer
- development of an insulin sensor for the daily monitoring of blood sugar in people with diabetes
- improved implantable device to prevent heart attacks in people at risk
- advances in understanding how nerves recover from injury or disease
- injury prevention studies
- prototypes developed for commercialization include a research camera, an artificial leg and a monitoring system for dialysis.

#### **9.4.2 Program Objectives**

The 1992 Strategic Plan established the following goals.

1. To maintain international standards of excellence through an appropriate and effective peer review system.
2. To manage expenditures to ensure the continuance of AHFMR for future generations while avoiding significant fluctuations in annual spending.
3. To maintain and strengthen basic research in order to discover the underlying causes of disease and provide a foundation for patient and health research, the practice of medicine and prevention of disease.
4. To expand AHFMR support of patient-based and health research in Alberta and lead new initiatives in these areas.

5. To maintain research education and training programs and encourage young Albertans to pursue research careers.
6. To encourage increased collaboration in Alberta, Canada and elsewhere among investigators, research institutions, governments, other granting agencies and the private sector.
7. To continue to promote the development of medical research-related economic activities in Alberta, including commercialization of innovation.

#### **9.4.3 Planning Processes**

The directions of AHFMR programs are determined by the Trustees, after consulting with a network of more than 300 advisors from Alberta, Canada, and other countries. Their expertise covers medical research, health, education, economics, technology commercialization and other fields. The 1992 strategic planning process consulted the major research and health-related stakeholders in the province.

Allocation of grants and awards relies heavily on the recommendations of peer review committees with regional, national, and international reviewers.

The decision to expand patient-based and health research in Alberta is based on the important need for research in this area and on AHFMR's unique position—it has the experience, infrastructure and record of excellence, to provide leadership in mounting programs that will address urgent health care issues arising from specific, widespread health problems and from escalating costs.

#### **9.4.4 Investment Level**

AHFMR will continue to invest the interest derived from the Foundation in a broad spectrum of basic, clinical and health research. Consistent with past practice, the investment in 1993/94 will be in the order of \$30 million, a level which will ensure the long-term viability of the Foundation fund.

#### **9.4.5 Organizations Involved**

The biomedical and health research activity in Alberta is concentrated in the two major cities. In Edmonton, this activity is focused at the University of Alberta Hospitals the Cross Cancer Institute, the Royal Alexandra Hospital and other teaching hospitals in the urban area. In 1992, this research grouping was supported by over \$43 million, obtained in successful competition from local, national and international granting agencies. AHFMR contributed over \$12 million to this total.

In Calgary, activity is concentrated at the University of Calgary, the Foothills Hospital and the Tom Baker Cancer Centre. This research grouping attracted over \$36 million in external funds in 1992, of which over \$12 million was contributed by AHFMR.

AHFMR programs concentrate on recruiting and establishing scientists in Alberta

institutions, on training young scientists, on information exchange through travel and conferences, and on research infrastructure. The operating support for the research activities, the actual project funding, is derived from a wide variety of national government and voluntary funding agencies.

The primary sources of outside dollars are the Medical Research Council of Canada, the Canadian Heart Foundation, the National Cancer Institute, and the National Health Research and Development program. Note that 30 AHFMR investigators participate in the Alberta nodes of the Federal Network of Centres of Excellence.

AHFMR also provides expertise, counsel, and funds for workshops and speakers to: Alberta Health, The Alberta Wellness Centre, provincial committees related to health, science and technology.

#### *AHFMR Major Funding Partners*

The Universities of Alberta, Calgary and Lethbridge  
The University of Alberta Hospitals  
The Royal Alexandra Hospital  
The Glenrose Rehabilitation Hospital  
The Foothills Hospital  
The Calgary General Hospital  
The Department of Economic Development Trade and Tourism  
The Alberta Cancer Board  
The Medical Research Council of Canada  
The Canadian Heart and Stroke Foundation  
The National Cancer Institute  
The Terry Fox Foundation  
The National Institutes of Health (USA)  
The National Centres of Excellence  
The Industrial Research Assistance Program  
The National Health Research and Development Program  
The Canadian Diabetes Foundation  
The Juvenile Diabetes Foundation  
The Canadian Lung Association  
The Alzheimer's Society  
The Arthritis Society  
The Multiple Sclerosis Society  
Many other voluntary associations

#### *1992-1993 Highlights*

- 1) The Glaxo-Heritage Institute for virology studies opened at the U of A. Glaxo Canada Inc. committed up to \$15 million, based on Dr. Lorne Tyrrell's promising drug for hepatitis B and other AHFMR-supported research.
- 2) The McCaig Centre at the U of C for arthritis and joint injury research celebrated its first anniversary. Calgarians donated \$2.8 million for the Centre, also supported by



**\$7.5 million from AHFMR.**

- 3) An AHFMR researcher was appointed to the Ciba-Geigy Chair in Schizophrenia Research, funded by the pharmaceutical company and the Schizophrenia society.
- 4) The new Primary Care Research Unit (for family physicians), was jointly funded by AHFMR, the Max Bell Foundation and Janssen Pharmaceutica.
- 5) An Eco-Research Chair for studying environmental risk management was established at the U of A with joint funding from the University, the federal Green Plan, AHFMR, the Government of Alberta, and 19 other partners.

#### **9.4.6 Key Program Elements**

The Foundation provides grants and awards under a series of programs that fall into four major groupings:

- Personnel Awards and Establishment Grants -- to assist in recruiting and establishing senior medical scientists in Alberta
- Training Programs -- to assist qualified medical scientists to further their training
- Research Support and Infrastructure Programs -- to assist the medical research community in acquiring equipment and access to the most up-to-date information and technical developments in medical research
- Technology Commercialization Programs -- to promote university/industrial collaboration in Alberta, stimulate technological innovation in Alberta, and advance medical research in Alberta to the stage where private investors may provide seed capital.

#### **9.4.7 Impact**

AHFMR research will continue to contribute to an effective health care system by generating new knowledge for better treatment, by providing a cadre of dynamic clinical experts, and by improving medical education.

AHFMR will further new initiatives in health research, working in cooperation with a broad group of provincial and federal stakeholders.

AHFMR investigators will continue to attract millions of dollars in outside funding, based on their excellence and successful track record.

Their innovations will spawn more technology commercialization activity in Alberta. Various innovations supported in the early stages of the TC Program will come to fruition in the next year and generally, the commercialization of medical research will be accelerated.

These activities have already put Alberta on the world map for medical research and our reputation will grow.

In the words of the 1993 International Review Board: *"The IBR is impressed with what has been achieved to date, including the Foundation's ability to respond to emerging need in health related research. We are confident that Alberta researchers and all potential users of their discoveries will be well served by AHFMR in the years to come."*

## **9.5 ALBERTA OIL SANDS TECHNOLOGY AND RESEARCH AUTHORITY**

**Alberta Oil Sands Technology and Research Authority has been amalgamated into the Oil Sands Research Division of Alberta Energy. The following program and proposed budget is subject to changes as the program is incorporated into the rest of the division and department programs and budgets.**

### **9.5.1 Introduction**

The establishment of AOSTRA in 1974 was a strategic initiative of the Alberta Government which anticipated many of the goals and operating principles outlined in "Alberta's New Economic Development Strategy - Seizing Opportunity". Its stated purpose is to build on the strengths of one of Alberta's most important sources of revenues and job creation, the petroleum industry, by stimulating the development of the technology which will be needed to keep this industry productive and profitable into the 21st century. AOSTRA operates primarily through joint projects with industry, universities and research institutions, which enable it to take advantage of the particular capabilities of each of these sectors and to establish productive linkages among these groups. A strong element of industry leadership is involved in AOSTRA's choice of programs, since almost all of its pilot scale and field projects arise from proposals by industry, and industry-dominated committees are responsible for the guidance of the institutional research programs.

For the past several years, AOSTRA has been placing special emphasis on the commercialization of the technology which has been generated in the course of its operations. Demonstration and pre-commercial scale projects have been given high priority and are carried out in partnership with the private companies which will be the ultimate users of the technology. AOSTRA devotes significant efforts to training the specialized personnel needed for the future expansion and diversification of the petroleum industry, and to providing convenient access to all information relating to oil sands, heavy oil, and enhanced recovery technology.

### **9.5.2 Historical Background**

By 1973, conventional oil production had become a major source of economic activity and government revenues in Alberta, but it was also evident that production capacity had peaked and was expected to decline by 500,000 barrels (80,000 cubic metres) per day by the year 2000. This shortfall would have to be made up by enhanced recovery and by heavy oil and bitumen production if Alberta were to maintain its position as the leading producer of liquid fuels in Canada, and if the country as a whole were to avoid dependence on imported oil.

The Alberta oil sands represented a very attractive solution since they were known to contain in excess of 1.7 trillion barrels (270 billion cubic metres) of bitumen in place. However, the only commercially-proven technology available for bitumen recovery was



extraction from mined oil sand, which was applicable to only about 5% of the total resource and also involved high front end costs and long lead times. It was evident that an expanded and sustained program of research, development, and field pilot testing would be required if the full potential of Alberta's oil sands resources were to be realized, so AOSTRA was established as a crown corporation by an Act of the Alberta Legislature to stimulate such activities.

### **9.5.3 Current Situation**

In 1974 when AOSTRA was created, technology existed to recover bitumen from the mineable oil sands for a total recoverable reserve of some 27 billion barrels. Today, through AOSTRA's efforts, together with those of the private sector, recovery can be achieved from all three of Alberta's oil sands deposits for a combined producible reserve in excess of 300 billion barrels. In addition, production costs have been reduced to half of their former value or less and are becoming competitive with the cost of producing Alberta conventional crude oil. Industry has used this technology in commercial development from the Peace River and Cold Lake deposits and is actively involved in recent advances in recovery from the Athabasca deposit.

Technology has also been advanced for recovery from Alberta's heavy oil deposits and for renewed recovery from abandoned light oil reservoirs. At the Joffre project, which has gone commercial, recovery has been increased 50% from a previously abandoned reservoir.

### **9.5.4 Program Objectives**

#### *General*

- (1) To generate the technology that would enable the exploitation of Alberta's immense oil sands resources and their conversion to marketable products.
- (2) To generate the technology for improved recovery from Alberta's heavy and conventional oil resources.

#### *Specific Contemporary Objectives*

- (1) Demonstrate, in a commercial scale production pattern, the impressive results obtained for the Twin Well concept of steam assisted gravity drainage from underground access.
- (2) Extend the concept of steam assisted gravity drainage using twin wells to surface access wells with application in all three major oil sand deposits.
- (3) Demonstration of the ATP recovery technology for a mined oil sand application.
- (4) Development of technology which will substantially reduce the cost of conversion of bitumen to transportation fuels.

- (5) Maintain an ongoing effort in technology transfer, institutional research, information dissemination, and training.

### 9.5.5 Proposed Investment Levels

AOSTRA's proposed investment level for the 1994/95 program is \$20 million as presented in Table 9.5.1 and allocated to programs as shown in Table 9.5.2. The estimated participation in AOSTRA's programs by other departments, the federal government and industry is indicated in table 9.5.3.

TABLE 9.5.1  
INVESTMENT LEVEL  
(Thousands of Dollars)

	1992/93	1993/94	1994/95	1995/96	1996/97
Research Investments	15,926	12,200	16,600	16,700	16,800
Administration	4,050	3,600	3,400	3,300	3,200
Total	19,976*	15,800	20,000	20,000	20,000
Percent Reduction Constant	Base Year	Constant	21%	Constant	Constant
Dollar Reduction	Base Year	(4,200)	Constant	Constant	Constant

\* Actual Expenditure of 19,976 on Budget of 20,000

The precipitous budget reduction of 21% from 1992/93 to 1993/94 was handled by AOSTRA delaying payments and research projects and through 20% of AOSTRA permanent staff accepting the voluntary severance package.

The recommended budget scenario provides the momentum for AOSTRA to fully accomplish the research strategy contained in "Seizing Opportunity" and fully take advantage of prior years investment in basic research to move the technology into demonstration and towards commercialization.

### 9.5.6 Organizations Involved

AOSTRA has established an impressive network of organizations which collaborate actively in oil sands and heavy oil research. During the years preceding the

Table 9.5.2  
AOSTRA Recommended Budget Scenario Summary  
To Accomplish Mandate and Mission

(Thousands of Dollars)

	1992/93	1993/94	1994/95	1995/96	1996/97
<b>Research Investments</b>					
<b>Institutional</b>	6,112	4,717	3,900	3,800	3,600
<b>Mining,</b>	1,434	352	1,000	1,200	1,200
<b>Field Production Pilots</b>	3,448	4,895	4,850	4,500	4,150
<b>UTF Project</b>	1,353	Nil	1,300	1,400	1,650
<b>ATP Tech Transfer</b>	3,396	1,936	4,150	4,000	3,800
<b>Upgrading</b>	183	300	1,400	1,800	2,400
<b>Total Research</b>	<b>15,926</b>	<b>12,200</b>	<b>16,600</b>	<b>16,700</b>	<b>16,800</b>
<b>Administration</b>	4,050	3,600	3,400	3,300	3,200
<b>Total GRF</b>	<b>19,976</b>	<b>15,800</b>	<b>20,000</b>	<b>20,000</b>	<b>20,000</b>
<b>Percentage Reduction</b>	Base Year	21%	Constant	Constant	Constant
<b>Dollar Reduction</b>	Base Year	(4,200)	Constant	Constant	Constant

\* Actual Expenditure of 19,976 on Budget of 20,000

establishment of AOSTRA, the R&D programs of industry tended to be fragmented and intermittent, and pilot tests were often based on processes developed elsewhere for use under quite different reservoir conditions. There was essentially no fundamental work underway on oil sands in Canadian Universities.

The network is now well developed: 19 companies are involved with AOSTRA in sponsoring university research at eight Canadian universities; 12 companies along with CANMET co-operate with AOSTRA in sponsoring in situ recovery research at the Alberta Research Council; while nine companies, including most of the major oil companies and two foreign companies from China and Japan, are joint partners with AOSTRA in the Underground Test Facility Project (plus Syncrude Canada as Associate member). In addition, most other projects funded by AOSTRA are jointly funded, with industry usually taking an operating role.



**TABLE 9.5.3**  
**AOSTRA 1994/95 BUDGET ESTIMATE (\$)**

	<b>R&amp;D</b>	<b>AOSTRA</b>	<b>RSA</b>	<b>ALBERTA</b>	<b>CANADA</b>	<b>OTHER CONTRIBUTORS INDUSTRY</b>	<b>OTHER</b>	<b>TOTAL</b>	<b>DIRECT EMPLOYMENT</b>
Institutional Research	2,500,000			1,110,000	400,000	4,075,000		8,085,000	134
Technology Handling			905,000			80,000		985,000	10
Training Activities			295,000			45,000		340,000	11
International Activities	60,000		40,000		60,000			160,000	1
Mining & Extraction	600,000			150,000		5,890,000		6,640,000	45
Technology, Transfer & Commercialization	4,150,000					2,600,000		6,750,000	95
Underground Access	1,300,000					3,600,000	6,000,000 <sup>1</sup>	10,900,000	70
In Situ Oil Sands	3,275,000					3,725,000		7,000,000	76
Carbonate Trend	100,000					100,000		200,000	4
Heavy Oil	250,000					475,000		725,000	16
Enhanced Recovery Con. Oil	1,225,000					3,715,000		4,940,000	62
Environmental Projects	400,000			150,000	300,000	5,300,000		6,150,000	43
Bitumen Upgrading	1,400,000			1,693,000	5,250,000	1,050,000		9,393,000	75
Management Engineering and Administration	3,400,000							3,400,000	37
<b>TOTALS</b>	<b>18,660,000</b>		<b>1,240,000</b>	<b>3,103,000</b>	<b>6,010,000</b>	<b>30,655,000</b>	<b>6,000,000</b>	<b>65,668,000</b>	<b>679</b>

<sup>1</sup>Revenue from sale of bitumen

The distribution of organizations involved in AOSTRA programs are as follows:

Major integrated oil companies	11
Exploration and producing oil companies	19
Engineering and consulting companies	50
Provincial government departments and agencies	11
Federal government departments and agencies	3
Academic and educational institutions	21
International organizations	29

#### **9.5.7 Decision Making Process**

The identification and selection of projects to be funded by AOSTRA is predominantly industry-led. Proposals from the private sector are reviewed for their technical and economic viability by an evaluation committee with the aid of expert external consultants, and a recommendation is brought to the AOSTRA Board for a final decision in the context of AOSTRA's priorities and availability of funds. In the case of major projects the applicant also makes a direct presentation to the Board. An appeal process is available which includes a personal appearance before the Board to clarify any issues.

Research proposals from universities are reviewed by the University Evaluation Panel, made up of representatives from industry and the Alberta universities, which makes recommendations to the Board. The overall direction of the joint oil sands research program with Alberta Research Council is provided by an industry-dominated Policy and Program Committee. The Petroleum Recovery Institute program is directed by industry members as is the Computer Modelling Group and Centre for Frontier Engineering Research.

In the special case of the Underground Test Facility (UTF) where the project was initiated by AOSTRA, industry was brought in at the earliest feasible stage through Management and Technical Committees, to provide guidance and to facilitate the subsequent commercial application of the technology. A formal invitation for one of the 10 industry participants in the UTF to replace AOSTRA as Operator of the UTF has been issued by the Alberta Minister of Energy. The industry Operator is expected to be the "Champion" to lead the project to commercialization.

The AOSTRA Board is composed of members appointed from the private sector by the Lieutenant Governor in Council. The Chairman and Vice Chairman of AOSTRA, in all cases to date, have had significant industrial experience.

#### **9.5.8 Key Program Elements**

##### **Institutional**

AOSTRA supports basic and applied research at universities and research institutions to provide the new concepts which will form the basis of future technology development. Emphasis is being given to those programs which have strong industry interest and support, such as the Oil Sands Research Program at the Alberta Research Council, the University-Industry Research Program, the Computer Modelling Group, and the Petroleum Recovery Institute. Support will continue to be given to the Strategic

Research Program at the ARC which is designed to move technology forward from research to field application.

### *Technology Handling*

As an important part of its mandate, AOSTRA makes information in the public domain from all parts of the world readily available to users, and makes technology developed by AOSTRA and its partners available at fair market value. AOSTRA also serves as a channel of communication with other agencies and the private sector for information and technical assistance which cannot be supplied directly by AOSTRA. This "one window" availability of information and technology has proven very useful to industry in the development of the resource, and has been a significant factor in AOSTRA's productive linkages with industry and researchers.

### *Training*

AOSTRA will maintain its efforts to interest young people in careers in the petroleum industry and to assist them in obtaining the appropriate training, at levels consistent with the availability of funds. Programs will include university scholarships and fellowships, summer employment, and a new graduates assistance program to obtain professional certification.

### *Mining and Extraction*

Support will continue on the application of the successful AOSTRA-TACIUK process and other processes which reduce tailings problems and/or lead to significant cost reductions in producing bitumen from mined oil sands. Industry is involved as consultive participants in the demonstration tests of the 5 tonne per hour ATP for oil sands processing, and engineering and cost studies have been initiated. It is anticipated that favourable results will encourage industry to move to a commercial demonstration. Further attention will be given to the use of hydraulic mining and ore transport in conjunction with new extraction processes as a means of reducing overall costs. Planning is proceeding toward demonstration of one or more alternate extraction technologies.

### *Technology Transfer and Commercialization*

The principal thrust in this area will be in commercializing the AOSTRA-TACIUK process (ATP) for cleanup of contaminated soils and for processing of oil sands and oil shales, and in the commercialization of the very effective Steam-Assisted Gravity Drainage Process as practised from Underground Access. These technologies have shown excellent commercial potential and will be strongly supported by AOSTRA, both as a means of seeing early commercial projects in the province and to facilitate the sale of Alberta technology, products and services. Modest funds will also be expended in promoting other AOSTRA technologies such as Anti-Water Coning Technology (AWACT).



## *In Situ Oil Sands*

The great success of the Steam-Assisted Gravity Drainage Technology with the resulting and sharp reductions in production costs, excellent recoveries and increased areas opened up for exploitation has prompted interest in application of this technology to deposits other than Athabasca and to its use from surface wells. AOSTRA is participating in a pilot operation involving two pairs of twin wells drilled from the surface in the Peace River deposit, and will pursue opportunities in the Athabasca and Cold Lake areas, in the Grosmont Carbonate deposit, and in the heavy oil areas. Other expenditures would be in the abandonment costs for completed projects and in engineering support for all developments.

- The pre-commercialized scale project operated by AOSTRA with nine industry participants for production of bitumen from the Athabasca oil sands by the twin-well Steam Assisted Gravity Drainage (SAGD) process is expected to reach its design capacity of 2000 barrels per day this fall. A formal invitation for one of the industry participants to replace AOSTRA as Operator has been issued by the Alberta Minister of Energy, and it is expected that this industry operator will lead the project through to commercialization.
- The SAGD technology developed at the Underground Test Facility is being applied in the Peace River oil sand deposit by Shell Canada Resources Ltd. using two pairs of 1000 m horizontal wells drilled from the surface. While experimental, the horizontal wells are being tied into the existing commercial project and their expected production of 1000 - 1200 barrels per day will add 10% or more to the total production of the project.
- The original Peace River In Situ Pilot (PRISP) will conclude operations in 1993 at the end of the fifth pressure cycle. The bitumen recovery will exceed 60 percent of the original oil in place, the highest recovery of any oil sands project prior to the SAGD process.
- An ATP Technology Demonstration Task Force of interested stakeholders from the petroleum and mining industries has been formed to oversee a demonstration program with the 5 tonne per hour transportable AOSTRA Taciuk Processor for extraction of partially-upgraded bitumen from mined oil sand. A mineable oil sand lease north of Fort McMurray has been assigned to AOSTRA as a site for a prototype-scale demonstration in partnership with industry if favourable economics are confirmed in the current program. The ATP is already being used commercially for clean-up of hydrocarbon contaminated soils in the United States under license from AOSTRA.

## *Heavy Oil*

Proposed research will be directed toward continued support of the use of steam, combustion and immiscible carbon dioxide (CO<sub>2</sub>) recovery as means of improved recovery of heavy oil. Increased use of recovery processes using horizontal wells will also be supported.

## *Enhanced Recovery of Conventional Oil*

Support will continue for CO<sub>2</sub> miscible recovery projects and for further testing of the anti-water coning technology. The main strategic thrust, however, will be in the use of horizontal wells to greatly increase recovery from our depleted conventional reservoirs. Some funds will also be expended on basic research and engineering studies.

- The ability of a carbon dioxide miscible flood to recover as much as 50 percent additional oil from the previously water flooded and abandoned Joffre Viking pool was demonstrated in a pilot project with Vikor Resources and other unit participants. The project was converted to a commercial operation at the end of 1990 and is being expanded in stages to cover the whole unit. Oil production (all of which is incremental) has reached 700 barrels per day for a total of more than 1.5 million barrels to date.
- Following a successful experimental project, an immiscible carbon dioxide flood in the Retlaw Upper Mannville "V" Unit was converted to commercial operation at the beginning of 1991. The project, operated by Ulster Petroleum Ltd. on behalf of 10 unit participants, is the first immiscible carbon dioxide project in Canada and has produced in excess of 750,000 barrels of oil from 25 wells.
- The "AWACT" Anti-Water Coning Technology for suppression of water coning into production wells is the first new enhanced recovery method to be commercialized on a field-wide basis in the past 20 years. Alberta Energy Company and Westcoast Petroleum are using AWACT in 35 wells in the Suffield South Jenner field with 630,000 barrels of incremental oil produced to date, and are planning to extend treatment to 300 wells. The technology is now under test in several other fields and has been licensed to a service company to provide commercial AWACT treatments on a "turn key" basis.

## *Environmental Projects*

Environmental projects will concentrate on water treatment projects to permit and improve water recycle in situ recovery projects, on research into reducing tailings ponds at oil sands plants, and on CO<sub>2</sub> removal and disposal.

### **(i) Expected Impacts**

The petroleum industry directly and indirectly generates a large proportion of the total economic activity in Alberta, and represents one of this province's principal strengths relative to other parts of Canada. However, its survival will depend on the availability of advanced technology for economical development of oil sands and heavy oil and for enhanced recovery of conventional oil, to offset the declining production from existing fields. Finding costs for conventional oil are increasing in Alberta, and it is expected with improved economics that oil sands, heavy oil and enhanced recovery will become the most attractive sources of new production within 10 years. An equally important goal will be to maintain the profitability of Alberta production during a period of low world oil prices.

The following are some of the expected impacts of AOSTRA's programs:

- (1) Revitalized commercial development of Alberta's oil sands by reducing production and conversion costs below the price envelope expected for the products. This will be achieved by:
  - a) confirming and demonstrating production costs of \$7/barrel;
  - b) lowering of upgrading costs by \$4/barrel and;
  - c) increasing the market value of the Synthetic Crude Oil produced.
- (2) Expanded use of horizontal wells, carbon dioxide, and other enhanced recovery techniques to prolong conventional oil production.
- (3) A strong scientific and technological base on which commercial development of Alberta's oil sands, heavy oil, and enhanced recovery resources can proceed.
- (4) A lower cost and expanded recoverable resource base.



## **9.6 ALBERTA RESEARCH COUNCIL**

### **9.6.1 Background**

#### **Mission:**

Responding to the needs of the private sector, and supporting activities of the public sector, the Alberta Research Council advances the economy of the province by:

- promoting technology development and application
- performing applied research
- providing expert advice, technical information, and scientific infrastructure.

By the year 2000, the Alberta Research Council's vision is to be an internationally recognized technology corporation, a valued, important partner in the emergence of a globally competitive Alberta.

The Alberta Research Council advances the economy of the province through the success of its clients and partners. Clients and partners range from small start-up companies to large multinationals, and also include municipal, provincial, and federal government departments. Contractual arrangements may be fee-for-service, joint ventures, or consortia. In addition, the ARC also provides technical advice and information to industry, government, and the general public.

The fundamental strategy of the Alberta Research Council is to maintain a technology infrastructure (the know-how of our staff and their tools) that can provide our Alberta-based clients and partners with an enhanced technology product or service. As a result, they can gain greater market penetration or percent of market share in the global marketplace, and hence increase export sales, create jobs, create wealth and contribute to deficit reduction.

Today, ARC operates a major oil sands and hydrocarbon recovery research facility in Clover Bar, and has established its coal and hydrocarbon processing facilities in the Coal Research Centre at Devon. A pulp and paper research program is in operation at the Clover Bar site. In Edmonton, the new facilities which opened in 1986 include a biotechnology pilot plant, the only one of its kind in Canada; manufacturing and testing laboratories, which support the manufacturing sector; and a forest products laboratory to assist Alberta's growing forest products industry. An environmental research group supports the sustainable development of Alberta's natural resources and diversification of the growing industrial base. In Calgary, the research emphasis is on advanced computing, engineering and manufacturing. Part of the environmental research activities are also located in Calgary.

Over the past five years, ARC has been working to strengthen its ties to industry. The Joint Research Venture (JRV) program has been instrumental in effecting this linkage. Through the JRV program, ARC works directly with an industry partner to develop new or more advanced technologies for the client company.

Some key successes in this program have been the development of recycled guard rail posts

using post-consumer oil containers and/or pesticide containers. This work has been done in collaboration with Elsro Asphalt Products Ltd. of St. Albert. The resulting benefits include an environmentally friendly alternative to conventional preservative-treated wooden posts at comparable cost, and the diversion of over 250,000 one-litre oil containers from the landfill. Elsro began manufacturing the product in Summer, 1993 and to date, have received orders from Jasper National Park, Kootenay National Park, Alberta Transportation, and the cities of Edmonton, Lloydminster, Calgary and Fort Saskatchewan.

Work with Crystal Mountain Water Cooler Corporation of Pickardville has resulted in the implementation of an automated manufacturing facility. The company has doubled their production capacity to 450 water coolers per day, is serving export markets in the U.S. and Europe and has created 35 new jobs.

The previous two examples, together with those that follow in the balance of this Research Overview, illustrate that research and development are contributing to both short and long term economic development of Alberta. The Alberta Research Council represents the "corporate" research arm for Alberta in partnership serving both the public and private sectors.

Enhanced private sector success generates wealth in the province through increased sales, profits and employment. Technology can enhance the success of companies by reducing their production costs or by being the basis of a new product or service. Technology can also serve as the basis for the creation of new companies. Many of the ARC business units, which work directly with industry, help them to create wealth in the province in this way.

Enhanced natural resource utilization is another mechanism of wealth generation in the province. For example, the work of the Forest Products Group has generated increased utilization of aspen (oriented strandboard industry) and pine (pine shakes industry). This has the dual benefit of increased sales of new products and employment in the private sector, and increased stumpage royalties for the provincial government.

### **9.6.2 Program Objective**

The fundamental goal of the ARC is to create wealth for the Province of Alberta. For the most part, the ARC does not create wealth directly; rather it creates wealth through its Alberta-based clients and partners by maintaining a technology infrastructure that can be used by its clients and partners to develop value-added technology products and services for the global marketplace. Increased export sales of value-added technology products and services creates wealth in Alberta, creates jobs and contributes to deficit reduction. The impact on the provincial economy resulting from ARC's activities is a product of ARC's mission effectiveness and the province's level of core funding in ARC. This is expressed in the following equation:

**Economic Impact = ARC's Mission Effectiveness x Level of Core Funding**

In 1992/93, \$100M of wealth was created for Alberta by the ARC's clients and partners directly as a result of their collaboration with the ARC. Since the ARC's core funding from the province was \$25M, therefore ARC's mission effectiveness was 4:1.

The ARC's goal for 1994/95 is to maintain its contribution to wealth creation in Alberta at \$100M per year, even though the level of core funding is being reduced. This will require that ARC's mission effectiveness increase to 4.4:1.

It can be calculated that wealth creation of \$100M per year has associated with it the creation of 3,000 new jobs per year and an annual contribution to deficit reduction of \$50M.

### 9.6.3 Investment Levels (\$ Million)

**Table 9.6.1**

Sector	Grant	Contract	Total
Manufacturing	4.76	3.16	7.92
Energy	6.96	5.99	12.95
Environment	2.55	2.12	4.67
Agriculture	0.37	--	0.37
Transportation	0.34	0.16	0.50
Health Technology	2.01	5.65	7.66
Forestry	1.01	1.31	2.32
Information Technologies	4.55	1.46	6.01
Total	22.55	19.85	42.40

### 9.6.4 Organizations Involved

The Alberta Research Council, as one of the largest and most diversified research organizations in Alberta, provides technology leadership in a number of key economic sectors. The president of the Research Council serves as chairperson of the Technology and Research Advisory Committee (TRAC), a key interdepartmental Alberta Government research co-ordination body.

He also serves on various industrial-led research and development boards, agencies and committees, such as the AOSTRA/ARC/CANMET/Industry Policy and Program Committee which oversees a major oil sands consortium research program, the Association of Provincial Research Organizations (APRO), and the Canadian Research Management Association (CRMA).

A large number of ARC scientists and engineers serve on an array of planning and co-ordinating bodies in Alberta's science community. ARC is actively involved in developing networks and information sources for manufacturers. This involves coordination and delivery of research programs between Alberta R&D organizations, sponsoring the development of industry-led business networks that increase provincial exports, and providing value-added information services to manufacturers. An example is the creation of Industry Alberta, a network of business, government, and labour that is jointly developing responses to opportunities arising from federal regional benefits programs. In addition to these organizational linkages, many of the programs of the Alberta Research Council are co-funded



and co-managed with various Alberta Government departments and agencies, the federal government, and industry participants.

International linkages of the Alberta Research Council range from collegial relationships with scientists and engineers in many countries to collaborative multidisciplinary research projects. ARC is currently developing a close relationship with the Standards and Industrial Research Institute of Malaysia. Co-operative research activities include work with organizations such as the Heilongjiang Academy of Sciences in China on the improvement of super absorbent polymers and the New Energy Development Corporation (NEDO) in Japan on coal gasification. In September, 1993 a licensing agreement was signed with Mitsui Engineering and Shipbuilding Co. Ltd. of Japan for ARC's clean coal technology, known as the Agfloat process.

### **9.6.5 Key Program Elements**

#### **1. Manufacturing**

- Objective:

To stimulate the performance (export sales, profitability) and size (employment) of the Alberta manufacturing sector by working with the progressive and innovative companies in those sectors of the economy expected to provide greater than average economic growth; to assist companies with new/improved processes or product development.

- Activities:

Practical and beneficial technology assistance to Alberta SMEs in:

- product development
- process development
- materials development
- chemical and physical testing
- computer integrated manufacturing
- information, awareness, and training services

- Expected Impact

- \$25 million in increased GDP in the province
- 300 new high-value jobs each year
- \$5 million in tax revenue to Alberta
- increased diversification of the provincial economy

#### **2. Energy Petroleum and Bitumen/Coal/Natural Gas**

- Objectives:

To increase the development and utilization of Alberta's heavy oil and bitumen resources through the development of "breakthrough" technologies that achieve

dramatic reductions in the cost of producing and/or upgrading.

To improve the performance of Alberta's energy companies or energy service companies through the development and/or adaptation of new technology products and processes.

- Activities:

Precompetitive research funded solely by government and industry membership contributions. Program will work closely with the Oil Sands Research Network (OSRN) and the National Centre for Upgrading Technology (NCUT).

In situ recovery technology

- reservoir geology
- numerical and physical process modelling
- reservoir and process visualization
- environmental process design

Upgrading technology

- synthetic crude oil quality
- transportation fuel quality
- reduced-step upgrading processes
- bitumen chemistry

Increasing natural gas utilization and the development of value added products:

- production technologies for value added hydrocarbons to enhance natural gas utilization
- acquisition and adaptation of new energy-efficient products
- reformulated fuels
- technologies for the use of alternative transportation fuels
- energy efficient and environmentally benign processes
- combustion for electrical production

Upgrading technology and transportation of energy products through the application of catalytic and non-catalytic chemical processes, physical processes, fluid mechanics and technical and economic evaluations for:

- beneficiation of coal
- upgrading of heavy oil and bitumen
- refining of conventional oil and natural gas processing
- pipeline transport of coal slurries, oil blends, refined products and bulk petrochemicals

- Expected Impact:

- \$32 million in increased GDP in the province
- maintenance/creation of jobs in the petroleum industry
- wealth generation through licensing of technologies developed and the sale of

- expertise
- substantial improvements in production technology and economics, leading to an increase in established reserves
- shortened time from concept to demonstration, application and commercialization
- more timely response to market needs

### **3. Environment**

- **Objective:**

To stimulate the performance (increased export sales, profitability) of the environmental services sector through the development and/or adaptation of new/improved technology products and/or processes.

- **Activities:**

- promote efficient operations and maintenance of existing industrial facilities through expert advice on on-site remediation, sludge and effluent treatment
- provide technical and economic assessment and modelling for ground water resources, water resource management, contaminant transport, reclamation and disposal of CO<sub>2</sub>
- develop and utilize information systems on industrial sites and tracking of environmental requirements and implementation strategy province-wide
- provide expertise to industry on expert systems technologies and adaptive process control
- provide expertise to government for effective decisions on environmental standards and regulations
- interpret regulations and provide expert advice to industry on standards
- provide courses and training to government, industry and international markets

- **Expected Impact:**

- \$15 million in increased GDP in the province
- achieve Alberta's goal of managing resource development and the environment with most of the economic benefits derived from increased profits to the primary resource companies through reduced costs and gains in greater efficiency
- good potential for increased business for firms in the environmental service sector derived from opportunities for expanding the technical capability of the firms, thereby creating potential for increased export of these services



#### **4. Health Technologies**

- **Objective:**

To stimulate the development of a sustainable biotechnology manufacturing industry in Alberta by spinning off new corporate entities, based on technology owned by the Alberta Research Council or acquired elsewhere.

- **Activities:**

- Pilot plant scale testing of fermentation processes
- Provide infrastructure support, scale-up and manufacturing capability for chemical based biopharmaceutical compounds and large scale carbohydrate chemistry production.

- **Expected Impact:**

- \$6 million in increased GDP in the province
- Economics for the agricultural industry will improve
- Alberta will produce non-food agriculture products for export
- Success will lead to a new biopharmaceutical industry in Alberta and technologies for world wide exploitation.

#### **5. Information Technologies**

- **Objective:**

To assist Alberta's information technology industry to develop products and services that will enhance its global competitiveness. New sector specific strategies will be developed in health care and energy. To make the ARC a leading Alberta organization in the application of advanced information technologies, providing strategic knowledge within ARC and to the private sector.

- **Activities**

- assist with the development and improvement of software products by the Alberta information technologies sector;
- assist with the application of advanced information technologies to important sectors of the Alberta economy: health, environment, natural resources, and manufacturing;
- facilitate the use of advanced information technologies to improve productivity and to implement process re-engineering within Alberta industry;
- work with the Alberta information technologies industry, government and educators to build an information technology literate and capable society in Alberta;
- work with national and international information technology consortia to bring

the benefits of new applied information technology research to Alberta industry;

- work to facilitate the implementation of high speed network capability within Alberta.

- Expected Impact:

- \$17 million in increased GDP in the province
- Increased employment and exports in the information technology sector through new businesses based on advanced information technology developments, new products for commercial use and the development of improved products with existing information technology providers
- Improved productivity in existing Alberta companies through the use of advanced information technology capabilities
- Improved competitiveness and diversification of the Alberta economy through the development of a knowledge based economy

## 6. Forestry

- Objectives:

To stimulate the performance of wood products manufacturing companies in Alberta through the development and application of new/improved products and/or processes.

To improve the performance (cost effectiveness, environmental) of Alberta's pulp and paper companies and pulp and paper supply/service companies (increased exports) through the development and/or adaptation of new technology products and processes

- Activities:

- Operation of a SCC accredited product evaluation laboratory for wood products
- Operation of a product development pilot plant for wood structural panel development
- support of industry-led research program in wood composites to increase the utilization of Alberta wood fibres
  
- diversification of research program into the solid wood area and alternate fibres
- future paper production research and development
- alternative/additional markets for market pulp
- expert systems application
- fibre-loss reduction
- alternative uses for sludge
- improved effluent treatment

● Expected Impact:

- \$5 million in increased GDP in the province
- Development of improved wood and wood composite products will lead to production of more value added components from Alberta's forest resources.
- Increased marketability of Alberta sourced products in world markets
- Strong alliances with other research organizations and industry allow clients to play a role in identifying technology required to meet international and domestic competition.
- improved operational techniques (improved profitability)
- tax benefits
- mill sludge utilization (product)
- improved reforestation
- improved agricultural production, marginal areas
- expanded market for newsprint
- job creation through secondary industry (recycling)
- job creation through expanded newsprint production

#### 9.6.6 Changes from 1993/94

Over the next three years, core funding to the Alberta Research Council will be reduced from \$24.6 million to \$19.5 million. Nevertheless, the ARC's goal is to continue to advance the economy of the province by \$100 million per year. The ARC will accomplish this by increasing its mission effectiveness from a 4:1 to 5:1 ratio. To meet the challenge, the ARC will phase out core funding from a number of research programs, including:

- the Alberta Geological Survey
- The Alberta Soil Survey
- groundwater, surface water and air quality monitoring
- electronics testing
- gasoline and oil testing
- pavement management research
- humane trapping

As a result of an extensive planning process involving many ARC employees and stakeholders, the ARC has concluded that it will accomplish its mission and vision primarily by working directly with its private sector clients and partners.

The ARC believes it can provide its clients and partners with a competitive edge in the global marketplace by working with them to develop value-added technology products and processes that will lead to greater export sales and job creation in Alberta.



## **9.7 ALBERTA COMMUNITY DEVELOPMENT**

### **9.7.1 Background**

This department went through major amalgamations and change in 1993/94, with the addition of recreational responsibilities and a number of individual rights agencies. Its new mission is to enrich the lives of Albertans and enable communities to reach their goals. Yet despite changes, the primary scientific work of the department still rests with the Cultural Facilities and Historical Resources Division. This Division operates a network of 18 provincial museums, interpretive centres, and historic sites, as well as dealing with resources management and community assistance issues. However, that area too has been reduced, restructured, and changed somewhat.

All research is now a curatorial nature supporting a collection or for developing an exhibit, and therefore no pure "R&D" monies remain. Rather the historical, archaeological, palaeontological and other natural sciences work is now all consumed within the Museums Services definitions of the Related Scientific Activities category, as are the rest of the responsibilities of the historical resources area.

A distinctive aspect of this Division's works is that aside from being "hands-on" public educators through their high quality facilities, their scientific interpretation leads to the provision of colourful attractions for tourists, generating millions of dollars for the service industries for host communities. It is the stimulation of the regional service sectors on which the economics of these investments of Alberta taxpayer dollars was predicated. To this end, the economic impact of tourism to Alberta's vibrant network of provincial heritage attractions is over \$20 million annually into hosting local economies, and overall expenditures in Alberta by non-local visitors to these sites average more than \$50 million annually. The Royal Tyrrell Museum alone generates \$7-10 million yearly for the Calgary-Drumheller region.

With respect to operating costs, this area is also aggressively pursuing alternatives to GRF support through admission charges, cost-recovery projects, corporate sponsorships and the like. It is hoped that these entrepreneurial activities channelled through a special Historic Resource (Regulated) Fund can help offset declining GRF budgets for core operations.

### **9.7.2 Departmental Objectives**

The historical resources area of the department is charged to preserve, study and interpret evidence of Alberta's human and natural history. It provides public education about our heritage, cares for our cultural and natural treasures, and stimulates heritage tourism. Its three main programme areas are as follows:

#### **1. Facility Operation:**

The Division operates a network of 18 provincial heritage facilities decentralized across the province.

## 2. Historical Resource Management:

Industrial development that may impact resources (tied to the EIA process) and scientific fieldwork are to some extent regulated to safeguard the resource base.

## 3. Community Assistance:

Technical and some financial (via Lotteries funding) assistance is available to encourage communities to take better advantage of and more responsibility for historical resource preservation and development.

**Table 9.7.1 Projected 1994/95 Budgets**  
(in millions)

<b>General Revenue</b>	<b>Regulated Fund</b>	<b>Lotteries Fund</b>	<b>People</b>
<b>RSA</b>	<b>RSA</b>	<b>RSA</b>	
<b>\$14.78</b>	<b>\$2.2</b>	<b>\$3.3</b>	<b>265 plus</b>
			<b>60 contractors &amp; 200 grantees</b>

### 9.7.3 Investment Level

While difficult to project at the time of writing (August 1993), it is doubtful that any R&D will occur, and the RSA will have dropped to approximately \$14 million, from the \$15.5 expected for 1993/94. Extrapolations into 1995/96 are not possible at this time.

#### *Impact of Cutbacks*

For this facility based organization, three-quarters of its GRF budget is associated with manpower to operate the provincial museums, interpretive centres and historic sites. With decreasing manpower and increasing crowds, the potential for serious problems are growing. If visitors become dissatisfied with poor service or lower standards, then tourism revenues to the communities will drop. Further budgetary cuts may well mean closing facilities only opened within the last fifteen years. In 1993/94, some 31 positions were lost by the Division.

### 9.7.4 Key Programme Elements

#### *Heritage Facility Development*

Over the last decade, Alberta has been a leader internationally in the rapid development of a network of heritage attractions. Not only are these hands-on educational institutions that provide meaningful and memorable educational experiences, but they also act as major tourism attractions. On average nearly one new museum, interpretive

centre or historic site has been opened each year since 1980, with a value averaging \$10 million per facility. In total, the visitor expenditures to the government operated facilities have a provincial economic impact approaching \$50 million annually, which can be increased substantially when considering the added effect of the community museums system. The primary role for the work of the Historical Resources Division is to educate, thus making Albertans more aware and appreciative of their colourful and distinctive heritage. School programming is an important aspect of the operation of all provincial heritage facilities. Departmental publications reach a broad audience, and museums are used by a wide cross section of Albertans.

However, beyond the socio-educational benefits, historical resources development has yielded major economic spin-offs for Alberta. The network of 18 provincial heritage facilities provides well in excess of \$20 million annually in regional tourism, and with the system of over 100 community museums, draws approximately 5 million visits per year. All museum visitors use local services in their trips.

The Department's work in the encouragement of the restoration of heritage buildings has also been significant, adding an aspect to the construction industry, that is labour intensive and environmentally friendly. For major areas, such building conservation has also meant low cost urban revitalization and the creation of districts of character (e.g. Old Strathcona, Fort Macleod, Stephens Avenue Mall, etc.). In turn, this has resulted in colourful areas of attraction with increased business and tourism.

In summary, historical resources provide us with tangible evidence of our distinctive and colourful past, which can make history come alive for both the student-visitor or scientist alike. They give us pride as Albertans, add to the quality of our lives, and also function as attractions to non-Albertans, who wish to know who we are and where we come from. This area has provided both strong socio-educational and economic returns on the taxpayers' investment.

### *Palaeontological Research*

The Royal Tyrrell Museum is the largest dinosaur facility in the world, and several of its scientists are establishing international reputations. This credibility has also brought a host of research exchanges and displays including work with China, Japan, Australia, and the United States.

The recent Gakken Project in Japan utilized 24 Alberta built dinosaurs in a special show viewed by one million Japanese within two months. This was Alberta's largest ever direct exposure of any kind in Japan. The show was a great success for its corporate sponsors, and for its contribution, the Tyrrell Museum received some \$2 million worth of exhibit specimens, various computer materials, and further recognition in Japan.

*The Dinosaur Project: China-Canada-Alberta-Ex Terra* is a multi-year, multi-million dollar research and exhibition programme involving several partners. The research phase produced some 60 tons of fossil materials from excavations in China and Alberta. More than a dozen new specimens of dinosaurs or fossil reptiles were discovered for the first time. In addition, many of the specimens collected were



among the best of their kind ever found. Over one hundred research papers have already been produced or are underway relating to the project. It has received media coverage in the New York Times, National Geographic, Omni, Discover, Newsweek, Natural History, CBC Journal and PBS Nova. The exhibition now under development will tour the world and be the largest such show ever seen. Moreover, the effort is building Alberta's ties with China, a nation containing one-third of the world's population.

Smaller research efforts are also occurring across Alberta with excavations at Dinosaur Provincial Park near Brooks, at Devil's Coulee Dinosaur Egg Site near Raymond, in the Drumheller area, the Crowsnest Pass, and near Grande Prairie.

#### *Archaeological Research*

This area has had a major scientific exchange with China, exploring early man migrations from the old world into the new world, and specifically through Alberta. Field excavations are continuing to study what is believed to be Alberta's early migration corridors.

Much of this unit's research is related to Historical Resources Impact Assessments, where sites with archaeological potential are threatened by development (e.g. sub-divisions, gas pipelines, forestry activities, etc.). In these cases, staff work with private consultants to glean whatever scientific knowledge is available from the subject areas and to intervene if appropriate. This research is mandated by the Historical Resources Act and is continuous and widespread and will ensure that archaeologically important sites are not destroyed.

#### *Natural History Research*

The Provincial Museum of Alberta is responsible for the development of collections reflecting the province's natural history, and the public interpretation of associated themes. Behind each display seen in the museum, extensive field and lab research has occurred. This again, is both continuous and widespread and will ensure that the people of Alberta have a record of their natural history for their education and enjoyment.

#### *Other Human History Research*

Both the Historic Sites & Archives Service and the Provincial Museum of Alberta are involved in a wide variety of human history research across the province on a continuous basis. Any public display in the Departmental facilities, and all publications, are backed by extensive research. As previously mentioned in the archaeological section, this too is linked to the Historical Designations - the legal protection of sites of heritage significance. Assistance is also provided to members of the public engaged in their own heritage research.

#### *Research on Economic Impact of Provincial Heritage Facilities*

Each year thousands of visitors surveys are collected at provincial museums, interpretive centres, and historic sites to obtain a profile of the people utilizing the sites, getting their opinions on programs and facility design, and examining their spending patterns. Alberta's survey is among the most extensive of its kind in Canada.

## **9.8 ALBERTA ECONOMIC DEVELOPMENT AND TOURISM**

### **9.8.1 Background**

Over the past two decades, Alberta's increasingly industrialized economy has realized substantial gains in growth and development. From 1971 to 1991, the size of the Alberta economy more than doubled in terms of real Gross Domestic Product.

Manufacturing and upgrading of primary resource products helped to diversify the economy during the 1970's and 1980's. However, investment in major capital projects, which has led much of the economy's growth in the past two decades, may not occur to the same degree in the foreseeable future. It is likely that a more broadly-based economy, with an increasingly diverse range of internationally competitive small and medium-sized enterprises, will prove to be a key engine for future economic growth.

It is recognized nationally and internationally that the economic challenges of the future, and the strategies by which they can be addressed, will pivot around an increasingly knowledge-intensive, science and technology based society and global economy.

Alberta's new economic development strategy document, "Seizing Opportunity" noted that:

"Science, technology, and industrial innovation are critical components of economic growth and diversification. It is clear that the old industrial economy is giving way to a new economy that is centred on information and leading-edge technologies. Investment in new technology and its commercialization is essential to keep pace with our competitors, and to generate wealth and create jobs. Science and technology is one of the main economic drivers of the 1990s, and is a substantial creator of wealth and jobs in our province."

A key element of Alberta's diversification strategy has been to broaden the province's economic base by encouraging manufacturing and the further upgrading of resources. This has helped to diversify the economy by expanding the product base above and beyond traditional resource commodities to higher value-added products.

The goal is to support the creation and linking of new, advanced and knowledge-intensive technology companies and industrial clusters and to encourage the application of advanced technologies to increase value added products in our traditional manufacturing industries. The application of these new technologies to manufacturing will improve product quality, reduce costs, increase value-added processing, and enhance environmental protection. This will result in increased competitiveness in global markets.

In terms of real value of shipments, Alberta's manufacturing base has more than tripled in size since 1970 to over \$19 billion and accounts for almost 26 percent of Alberta's

GDP. Alberta's manufacturing sector consists primarily of value-added resource products, such as petrochemicals, forest products, processed foods and refined petroleum products, and industrial goods, including oil and gas field equipment, fabricated metal products, transportation equipment, electronic products and construction materials.

The importance of Alberta as a trading province continues to expand, as the value of international exports reached \$19.5 billion in 1992. International exports accounted for about 25% of Alberta's GDP in 1992. In addition, it is estimated that as many as 250,000 Albertans are directly or indirectly employed as a result of international trade.

Tourism is another sector making an important contribution to Alberta's economic growth and diversification. In the last two decades, the province has also been successful in expanding and diversifying its markets. The number of off-shore visitors to Alberta, for example, doubled from 1985 (230,000 visitors) to 1992 (451,000 visitors). Tourism in 1992 produced revenues of \$2.9 billion, just under half of which (48%) came from out-of-province visitors.

### **9.8.2 Department Objectives**

The Department's Mission is: "To develop and facilitate a favourable business climate and infrastructure that promotes a competitive private sector in the province, allowing the generation of wealth and jobs for Alberta."

The overall economic development and diversification strategy of the Department encompasses several key elements and programs. These include:

- support the creation and expansion of new technology-intensive companies and industrial clusters which are based on the development and commercial application of advanced technologies
- encourage the application of advanced technologies to increase value-added in the traditional resource and manufacturing sectors
- planning and policy formulation
- business counselling and development
- manufacturing, processing and industrial services development
- business finance development
- industry attraction
- investment promotion
- export/trade development, and
- tourism development and promotion.

The activities of the Department are focused on the diversification of the Alberta economy and improving business competitiveness by supporting the creation and linking of advanced technology and knowledge intensive companies and industrial clusters. These activities are aimed at strengthening the private sector through research and technology development, business and entrepreneurial development, trade and investment promotion, focused industry attraction, and support to resource upgrading and advanced manufacturing. To support this mission, the Department works closely



with other line departments and levels of government, as well as with the private sector, in coordinating and integrating its various activities.

**TABLE 9.8.1**  
**DEPARTMENT'S ESTIMATED R&D INVESTMENT LEVEL**  
**FUNDING 94/95**  
**(\$ Millions)**

	Department		Federal	Industry
	R&D	RSA		
Tourism		0.22		
Manufacturing Expertise/Technology Industry Development Awareness (META) missions		0.05		
Western Economic Partnership Agreement (WEPA) - Telecom	1.00		0.50	
Canada/Alberta Partnership Agreement in Forest Products (C/APAIF)	0.50		0.50	2.0 <sup>1</sup>
Forest Products Research and Development	0.80			1.6 <sup>1</sup>
Annual Contribution to Forintek	0.10			
Networks of Centres of Excellence	0.40		5.00	
Technology Commercialization		0.70		3.30
International Technology Transfer		0.10		
International S&T Exchange		0.02		
Westaim	5.40		5.50	13.20
High Performance Computing	1.40			1.29
Research Institute Support	3.27		1.00	4.00
<b>Total</b>	<b>12.87</b>	<b>1.09</b>	<b>8.10</b>	<b>21.79</b>

<sup>1</sup>Projected industry contribution based on 1993/94 ratio.

### 9.8.3 Organizations Involved

Economic Development & Tourism is involved in the exploitation of new business

development potential of new and emerging technologies, processes and products. It is in these areas that the Department is most actively involved in terms of related expenditures and planning.

The ten regional offices of Economic Development & Tourism provide basic business support to companies in their respective regions. This includes the provision of business counselling services and information on economic opportunities and government programs.

The Industrial Research Assistance Program (IRAP), an NRC program with strong support by the Alberta Research Council, is an important delivery mechanism for providing technical assistance to specific companies.

The Western Economic Diversification (WED) Program of the Federal Government provides financial support to industry, and the Department works closely with WED in helping companies access this program. Other federal programs are also utilized on a project-by-project basis, i.e. IC (Industry Canada) and NRC-IRAP.

The Department is also involved in cooperative activities with industry partners to identify projects which are frequently done on a cost shared basis. In recent years, tourism projects have been carried out with participation from, among others, the Tourism Industry Association of Alberta, Alberta Hotel Association, Economic Development Edmonton, Calgary Convention and Visitors Bureau, and the Canada West Ski Association.

#### **9.8.4 Key Program Elements**

The strategies and activities of the Department concentrate on services and program delivery across an "innovation spectrum". This spectrum reflects the fact that the development of technology-intensive products, processes, and services is a cumulative process, built upon an evolutionary sequence of basic research, applications research, prototype development and testing, iterative refinement, transfer to business enterprises, and ultimately manufacture and commercialization.

Department strategies have been designed to provide support for:

- basic research aimed at advancing the body of scientific knowledge which serves as the foundation for virtually all technology-intensive products, processes, and services;
- applied research and development aimed at converting knowledge into new or improved products and processes;
- transfer of technology and knowledge into the hands of entrepreneurs and industry;
- specialty state-of-the-art research infrastructure facilities which are relevant to, and needed by, local industry but which lie beyond the financial means of many individual firms;

- development, expansion, and attraction of companies which will constitute Alberta's technology-intensive industrial clusters:
  - a) emerging companies - indigenous Alberta enterprises needing assistance to bring first products to market
  - b) threshold companies - those facing the proposition of having to expand proven technology capabilities to second generation or diversified products
  - c) strategically significant companies - typically large multinationals whose presence in Alberta would have major positive impact vis-a-vis local suppliers, job creation, local and export markets, research competence, and other spin-off benefits
- strategic alliances between Alberta firms and national and international companies and institutions where economic growth will result from shared research and development activity, technology exchanges, and increased capital resources
- corporate venturing and network linkages between universities, industry and government which are necessary for optimal economic progress (i.e. pre-competitive joint research ventures, co-operative interprovincial or international projects seed funding initiatives, business support networks)
- technology adoption and adaptation aimed at increasing the utilization of technologies in traditional industries and areas that are of emerging public significance (e.g., the environment, health care)
- manufacturing expertise missions-the intent of which is to improve the competitiveness of Alberta companies by providing them the opportunity to investigate and acquire the most up to date processes, equipment and technology. During 1993-94 the program facilitated the participation of 57 Alberta companies in 12 manufacturing expertise awareness missions.

### **Forest Products R&D**

Forest products R&D proved to be critical in facilitating the recent development of the forest industry in Alberta. It will remain important in the next phase of development which focuses on higher value-added production and greater fibre utilization. Promoting forest products R&D will be one of the key priorities of the Forestry Industry Development's (FID) mandate in 1994/95. The FID R&D program will continue to focus on the following activities:

- Provide cost-shared support for applied research and development in pulp and paper, new forest product technologies, composite board and solid wood in order to add further value to Alberta's forest resources.



- Explore possible new directions in R&D through networking with the Alberta Research Council (ARC), Forintek Canada Corp., Structural Board Association of Canada, the University of Alberta, the Forest Engineering Research Institute of Canada, the Pulp and Paper Research Institute of Canada and other research agents.
- Place emphasis on the use of under-utilized species such as balsam poplar and white birch to produce engineered wood products and higher value solid wood products.
- Provide assistance to industry regarding the development and/or revision of wood product codes and standards; market access and product promotion; identifying environmental friendly products and processes and ways of reducing and using fibre.
- Facilitate the application of advanced technology in forest product manufacturing.

**Value-Added Sawmill Program-** Provides technical assistance to small and medium sawmills for modernization, technological improvement and product development. Approved projects require matching contributions from industry.

### **Accomplishments In Past Year**

#### *Process Improvement and Productivity Gains*

Advances were made in new resin formulae and reducing press times to allow OSB producers to gain more production over regular 8 hr. shifts without experiencing any decrease in product quality. The ability to use different species of wood to produce OSB allowed this industry to reduce its raw material costs. An increase in panel board process efficiency of between 5-10% is anticipated to result in cost savings of about \$5 million per mill. A new gluing system has allowed a producer of laminated beams to reduce its manufacturing costs by 25%.

#### *Environmentally Acceptable Waste Disposal Methods*

Research in reducing and using byproducts of the pulp & paper mill process has allowed both the mechanical pulp mills and the kraft mills to reduce their costs for landfill, and possibly obtain longer term benefits in soil and forest site productivity by applying process wastes onto forest and agricultural land. Reduction in landfill costs of about \$500,000/yr. will accrue to each of the three mechanical pulp mills as a result of having to treat less effluent.

#### *Product Acceptance and New Market Development*

Assistance was provided to companies manufacturing added-value type wood products,

such as laminated beams and shingles, to obtain product acceptance in foreign markets. This has allowed them to expand their production, increase returns and diversify their customer base. Offshore sales of glue-laminated beams have increased from \$500,00 to \$2 million and are expected to double each year for the next three years. Expansion of the shake market in the U.S. has allowed one company to more than double its production from 5,000 squares/month to 12,000 squares/month.

#### *New and Improved Products and Processes*

A few Alberta firms have designed new scanning and sawing systems for sawmills and panelboard plants which improve product quality and add more value to the finished product through higher grade recovery or better product properties. Another company has developed a computerized log transport system which will lead to improved savings in harvesting and delivery of logs to the mill site. Two companies are already selling internationally and sales are estimated at \$1 million. Improvements in log and chip hauling systems should realize an overall savings of about 10% which amounts to about \$10 million.

#### **Advanced Technology R&D Infrastructure**

##### *Alberta Microelectronic Centre (AMC)*

Through the Western Economic Partnership Agreement in Communications Technologies, the AMC has received \$900,000 from Communications Canada towards the development of a silicon micromachined microphone. This joint industry project has the potential to replace present microphones in all telephone products.

##### *The Laser Institute (TLI)*

The laser jobshop has become a profitable entity within the Institute. Steps are now underway to spin-off this group into a private company which will offer laser-related services to industry.

##### *Telecommunications Research Laboratories (TRLabs)*

TRLabs is a pre-competitive telecommunications R&D organization headquartered in Edmonton with labs in Edmonton, Calgary, Saskatoon, and Winnipeg. TRLabs is "Dedicated to Providing People and Technology for the Future".

Wireless is the fastest growing segment within the telecommunications industry. With this in mind the federal and provincial governments have funded a program to set-up, implement and operate a telecommunication R&D facility in Calgary dedicated to wireless communications. The Calgary lab employs some 30 people - professors, industry researchers, students, and staff.

##### *Centre for Frontier Engineering Research (C-FER)*

Recently developed a major cost savings for arctic structures. Formed a joint industry

project on oil field production performance as well as collaborated on an improved design of dragline buckets.

### *Technology Transfer*

- Intellectual Properties and Contracts Office (University of Alberta)
- University Technologies International Inc. (University of Calgary)
- Applied Research and Product Development Program (Northern Alberta Institute of Technology)
- Alberta Heritage Foundation for Medical Research Technology Commercialization Program (AHFMR-TCP)

### **Federal/Provincial/Industry Collaborative Initiatives**

- Canada Alberta Partnership Agreements (CAPA) in Communication Technology and Forestry
- Forest Product Research Subagreement under the Canada/Alberta Partnership Agreement in Forestry
- Canada/Alberta/Sherritt-Westaim initiative in advanced materials is nearing completion of 5 key products and technologies which will have a significant industrial impact in a variety of industrial fields.
- High Performance Computing (HPC Inc.) is a \$38 million industry-led project that will establish a national centre for high performance computing and research in Calgary. High performance computing will be applied in a variety of areas, such as pharmaceutical drug design, seismic processing, materials research, environmental modelling, and medical diagnostics. This centre will enable Alberta industries to become more internationally competitive and will attract business to Alberta.
- Networks of Centres of Excellence (NCE)

The purpose of the NCE program is to advance technological breakthroughs, develop new technologies, and transfer these to industry for commercialization.

Strong university/industry partnerships have been developed not only within provinces but also on an interprovincial level. Progress has been made in technologies critical to future industrial competitiveness.

The federal government has attempted to ensure industrial as well as provincial support for the program. Alberta provincial funding was approximately one-fifth of the federal contribution to Alberta researchers. Industry partners have also been involved in networks where appropriate.



The first phase of this program has been completed and the federal government has recently announced that they will continue support for the successful networks, and possibly add new ones.

- Canadian Network for Advancement of Research, Industry and Education (CANARIE) is a coordinated national effort by industry, government, universities and the research community to establish a dedicated high speed digital communication network in Canada.

In addition to providing a national link, CANARIE is designed to provide Canadian industry with a test bed to develop new information technology products and services.

ARNET is the provincial network which will connect computer systems operated by Alberta research and education institutions to CANARIE.

- Earth Environment Space Initiative (EESI)

The Earth Environment Space Initiative is a joint initiative undertaken by the four western provinces and four leading western space firms (including Intera Technologies in Calgary) to work with the Canadian Space Agency (CSA) to define, implement, and launch a new small satellite and to develop supporting ground-based systems. The EESI project is designed to be largely performed by western industry and will expand the commercial application of remote sensing techniques and systems to environmental and resource management problems. The total value of the project is expected to be \$200 million. EESI is the first step in the process of developing a complete space-based environmental monitoring capability.

- Canadian Environmental Technology Advancement Corporation (CETAC)

In June '93, the federal government announced that it was providing \$4 million over 4 years from the Green Plan's Technology for Environmental Solutions initiative, for establishment in western Canada of the Canadian Environmental Technology Advancement Corporation (CETAC). The CETAC proposal was developed by a consortium including the four western provincial governments, their four environmental industry associations and provincial research organizations.

CETAC expects to assist in the development of 20 to 30 new environmental technologies over the next four years, resulting in \$10 to \$35 million in new investment in the Canadian environmental technology marketplace during that time. CETAC's partners will contribute significant financial and in kind support towards the establishment and the operation of the Centre during the next 4 years.

Through a wide range of services, CETAC will help small-to-medium sized enterprises to take promising environmental technologies from the lab to

marketplaces in Canada and around the world. The not-for-profit Centre will operate at arm's length from governments. The assistance to companies will include:

- assessing innovative technology and providing technical assistance;
- providing a matching service between entrepreneurs with ideas and groups that can help turn them into products and services;
- assessing international environmental networks in order to locate foreign sources of technology and to promote Canadian technology;
- tracking environmental regulations both in Canada and abroad to identify market opportunities and barriers to technology development;
- keeping abreast of the state of the environment and assessing its impact on the market place; and
- bringing together technology developers with venture capital and financing groups.

#### **Science and Technology Awareness and Outreach**

- School Awareness Programs/Science Week
- Science Alberta Foundation
- Alberta Science and Technology Foundation (ASTech)

#### **Technology Commercialization**

- Compression Technologies Inc. - Data compression products will have a major impact on reducing telecommunications costs for industry, deferring capital equipment upgrade for teleco's.
- Brougham Geoquest - Remote sensing of buried deposits of aggregate will significantly reduce road construction costs through discovery of new sources and reduced transportation haul costs.

#### **International Technology Transfer**

The purposes of the International Technology Transfer Program (ITTP) is to arrange and develop collaborative arrangements between Alberta organizations and organizations in designated countries on joint research and development, technology transfer and commercialization.

As a direct result of this program, revenues of over 1/2 million dollars were achieved

during 1993 alone. Other direct benefits have included increased staff levels for some participating companies, joint distribution agreements, increased international reputation; and cross manufacturing of technologies.

Agreements between Alberta and a number of foreign countries currently exist that ensure support for the proportion of joint research and development projects. Projects are funded by participating companies from both countries as well as both government bodies. This program has also assisted other Alberta government Agencies to cooperate with foreign partners. Alberta has been approached by other countries to enter into similar agreements to those that are already in place. This would increase the opportunities for the Alberta industry.

### **Science and Technology Exchange**

The purpose of the program is to provide assistance for joint research projects between Alberta researchers and foreign researchers.

Several joint papers were published as a result of projects between Alberta and Heilongjiang researchers. Specifically, the superabsorbent polymer project is very close to commercialization and prospects for a production facility in Alberta are good. Advances are being made in the improvement of concrete for cold weather use. Improvement of wheat varieties is also an important project involving two other foreign countries - Japan and China.

To date, the program has involved researchers from Heilongjiang (China) and Hokkaido (Japan), as well as their provincial governments. Projects have involved a number of Alberta Government Departments and the Alberta Research Council.

### **Tourism Development**

- The department will participate in the Canadian Travel Survey, a major biennial survey of travel by Canadian residents.
- market and product potential studies and economic impact analysis

### **Alberta Action on Waste - Industry and Market Development**

The program was cancelled as of April 1, 1994. Under New Products and Process Technology, the program supplied assistance to businesses for development of new products and process technologies. This encouraged businesses to broaden the "environmentally friendly" products base of the province.

The second component was support for Market Intelligence, including determining market size and quality requirements for developing commercially viable products.

The third component was capital support, on a cost shared basis, to enable the purchase of new equipment for recycling and market development. Assistance under all three components was provided on a cost share basis.



## ***Accomplishment***

Twelve new product and process technology projects were approved in 1993/94. Total investment by applicants was \$2.6 million. These 12 projects are expected to create 70 permanent manufacturing and processing jobs, revenues of \$7.9 million and exports of \$6.3 million the first year after completion. The resulting waste diversion from municipal landfills is expected to be 58,000 tonnes per year.

### **9.8.5 Expected Impact**

Competitiveness is often defined as being "cost-based", with labour, transportation, raw materials and other input costs being the key determinants. While these are important considerations, Alberta's ability to compete is also strengthened through technological innovation and other improvements aimed at increasing productivity. Moreover, the quality of the products or services being offered is becoming increasingly important to competitive success. Once again, the Department's program, service and policy initiatives are primarily focused on the diversification of the Alberta economy and on improving business competitiveness in these and other areas.

The Department sponsors or financially supports studies pertaining to the economic or industrial development aspects of research-related activities. For example, the Department is currently engaged in a study with the other western provinces and the federal government to identify existing capabilities, strengths and expertise within Western Canada's environmental industries. The study will also recommend possible approaches for greater inter-regional cooperation in areas such as business and trade development, R&D and technological innovation.

It is estimated that investment in the forest products industry over the next few years will be in the order of \$1 billion and 2,500 direct new jobs created. Forest products R&D will play an integral part in bringing about this investment by identifying and demonstrating new and improved products and processes, particularly in the value-added sector. It will be important to maintain the long-term competitiveness of the industry.

### **The Planning Process**

The Department developed a three-year business plan which identifies major goals to be achieved over that time frame. External client/stakeholder input is being solicited and priorities will be established. Since all of the research and development is delivered by external parties, detailed planning of annual activities is initiated by the relevant agencies, but reviewed, discussed, and broadly approved by the department and appropriate senior officials of the Department.

The focal point of the Forestry Products R&D program begins with the Alberta Forestry Research Advisory Committee (AFRAC) which sets the overall R&D priorities for Alberta in forestry. The committee is comprised of senior management from government, industry, the U of A and ARC. AFRAC sets broad priorities for

forestry R&D which includes forest products. A consultation process has also been in place among ARC, Environmental Protection and Economic Development and Tourism to address forest products R&D issues of concern to Alberta. An industry/government steering committee has been in place to direct the B-2 Subprogram under the Canada/Alberta Partnership Agreement in Forestry.

### **Coordination**

Extensive cooperative networks exist between the Branches of Economic Development and Tourism, other provincial and federal departments and agencies, research institutes, and firms and associations within the private sector. Much of this interaction is on an "as needed" basis, at the technical, project or issue specific level. Efforts are presently underway to formalize some elements of these networks, especially with regard to broader issues of strategic planning and coordinated program delivery.

The department has established alliances and networks with the Alberta Research Council, Forintek Canada Corp., the Forest Engineering Research Institute of Canada, the Pulp and Paper Research Institute of Canada, the University of Alberta, The University of Calgary, the Alberta Institutes of Technology, Forestry Canada, Energy, Mines and Resources, Industry and Science Canada, Western Economic Diversification, NRC, and the Northern Alberta Development Agreement to coordinate research planning and funding.

The Department coordinates the development of an annual Global Business Plan. The plan sets out the Government's global strategies for trade, tourism, investment and technology acquisition. It also outlines proposed cooperative industry government activities for the coming year designed to help companies expand their reach outside Alberta. The process helps in the development of common goals, strategies and activities to ensure that Alberta is internationally competitive.

## **9.9 ALBERTA ENERGY**

### **9.9.1 Introduction**

The Department of Energy is in the midst of a major review of its activities and organization, which will result in considerable restructuring. Concurrently, the Department is preparing an initial draft business plan for the next three years, in response to the Provincial Treasurer's request that the draft be based on reduction scenarios of 20% and 40% by 1996-97. In addition, the Department is reviewing the energy Research, Development and Demonstration activities within the Ministry of Energy with a view to their consolidation.

Because of the above unresolved situation in which the Department finds itself, it is important to stress that the following information is based on its current status, rather than on presently unsubstantiated projections and forecasts.

### **9.9.2 Background**

The mission of the Department of Energy is to facilitate orderly development and upgrading of Alberta's energy and other mineral resources to obtain optimal economic return for Albertans. This is achieved through expanded industrial activity with minimal impact on the environment of resource development and use.

The resources overseen by the Department of Energy include remaining established reserves (end of 1992) of 446 million cubic metres (2.8 billion barrels) of light and medium crude oil, 103 million cubic metres (648 million barrels) of heavy oil, 644 million cubic metres (4.1 billion barrels) of crude bitumen, 1,594 billion cubic metres (56.6 trillion cubic feet) of natural gas and 33 billion tonnes of raw coal.

The department is also responsible for the management of the provincial crown-owned industrial and metallic minerals, acting as stewards of this resource.

In 1992, Alberta's energy industry employed approximately 153,000 people, and the extraction and sales of energy resources contributed revenues of \$16.6 billion to Alberta's economy, and \$2.25 billion to the public purse.

If the Alberta energy industry is to continue to be a major wealth-generating component of the Alberta economy, it is essential to continue developing and applying new technologies. These new technologies are needed to meet increasing environmental standards, to maintain or increase the energy industry's competitive position, and to upgrade Alberta's energy resources to higher value-added products. As well, many of Alberta's resources have not been fully explored, evaluated and exploited. For example, the renewable solar and wind energy resources of southern Alberta show promise of being used on a large scale. Also, the presence of substantial amounts of hydrogen in Alberta's sour gas resources needs considerable investigation. This could allow recovery of hydrogen, which is a highly valued product that is being used increasingly in the energy industry. In addition, Alberta possesses numerous



deposits of valuable minerals

**Table 9.9.1**  
**Employment in Alberta's Energy Industry**

<b>Industry</b>	<b>Employment 1992</b>
Coal Mining	6,400
Oil and Gas Upstream	63,000
Refining	24,700
Services for Oil and Gas Industry	35,800
Pipelines	4,300
Utilities	11,000
Energy Industrial Construction	7,900
<b>Total Energy Sector</b>	<b>153,100</b>

whose full commercial impact has not yet been identified and characterized. The development of all these non-renewable, renewable and non-energy resources can contribute enormously to the diversification and growth of Alberta's resource industry.

Compared with the \$16.6 billion annual contribution these resources make to Alberta's economy, the research investment proposed by the Department of Energy for 1994/95 to help maintain or increase this contribution is \$5.96 million. This represents 0.036 per cent of the annual resource revenue.

### **9.9.3 Department Objectives**

In view of the Alberta government's fundamental concerns with the societal benefits of wealth generation, jobs and operational savings and efficiencies, and the Department of Energy's role in facilitating the optimal recovery of these resources for the benefit of all Albertans, the Department has established the following research and development objectives:

- through co-management (with the Alberta Research Council) of the Alberta Geological Survey, ensure development and publication of baseline geoscience information. Successful resource development world-wide is closely linked to the existence of an efficient and effective geoscience agency, which provides baseline geoscience information to the public. The availability of such geoscience information empowers the private sector to engage in responsible exploration and development of Alberta's oilsands, coal, and industrial and metallic mineral resources;
- through a coal research program, develop clean coal-burning technologies for long-term, environmentally acceptable and safe use of coal as the fuel of choice for

generating electricity;

- through a hydrogen research program, develop technologies for producing, transporting and using hydrogen more efficiently to upgrade Alberta's energy resources and produce ammonia and methanol, and develop new uses for hydrogen;
- through a renewable energy research program, develop and demonstrate technologies for exploiting Alberta's solar, wind and hydro resources; and
- through a mineral development agreement with the federal government, further characterize and exploit Alberta's non-energy mineral resources and maintain an up-to-date geological data base and assessment of Alberta's earth resources.

Not included in programs currently conducted by the Department are large-scale hydro developments and research concerning nuclear energy, heavy oil and oil sands and energy efficiency. Large-scale hydro is perceived to be a mature technology that has limited application in Alberta in the foreseeable future, while nuclear energy is believed to be unnecessary in a province having abundant and diverse energy resources. Heavy oil and oil sands technology research are excluded because they are the mandate of the Alberta Oil Sands Technology and Research Authority. As indicated in the introduction, the expected restructuring of research related activities within the Ministry of Energy will likely consolidate all R&D program activities into one agency.

#### **9.9.4 Proposed Investment Level**

##### *Research Program Funding*

Funding of both the Coal and Hydrogen Research Programs was initially almost completely dependent on the support from the Alberta and federal governments through the Alberta/Canada Energy Resources Research Fund (A/CERRF). Significant cost sharing with industry started in the mid 1980s in the Coal Research Program. The Hydrogen Research Program benefited from experience with industry cost-sharing already in its second year.

It is important to note that Alberta Energy's research and development investment is now consistently leveraged as much as 4:1 by industry, federal and other provincial governments and international agencies. The historic funding development of the Department's Coal and Hydrogen Research Programs is shown in Figures 9.9.1 and 9.9.2 respectively.

Figure 9.9.1

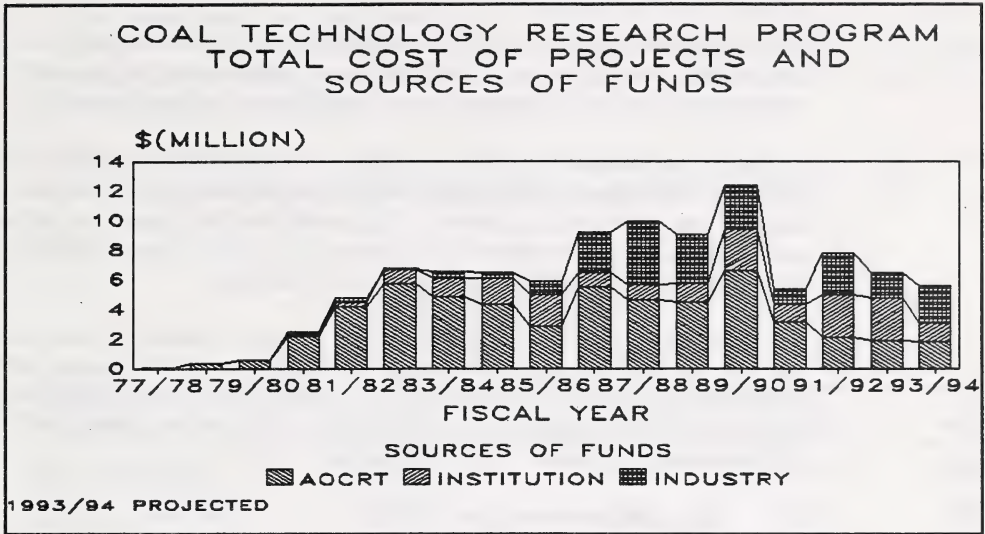
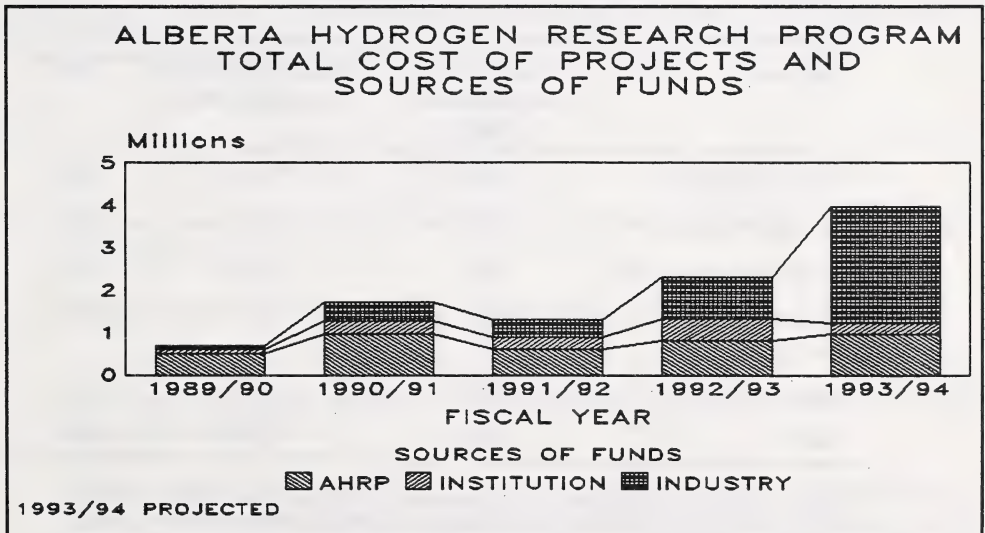


Figure 9.9.2





### *Impact of Budget Reductions*

The budget available for Coal Technology Research has been declining since 1989/90. This limited funding was a significant contributing factor in the rejection by the Department of proposals for over twenty promising coal research projects in 1993/94.

Similar rejections have occurred in the Hydrogen Technology program, but they have been kept to a minimum by reducing the Department's funding contributions below those requested by other funding partners. This has allowed the Department to participate in most of the proposals brought to it for approval. In 1993/94, however, only 10 projects will receive funding out of 16 recommended for funding.

As a result of the successive reductions of the budgets available for both coal technology research and the hydrogen technology program over the past four years, both programs have reached a critical financial level, below which one or both should be stopped if further significant budgetary cuts are imposed. The positive alternative is to let them both remain at their present levels of funding.

#### 1. Proposed Investment for 1994/95

The research investment proposed for 1994/95 is shown in Table 9.9.2

**Table 9.9.2**  
**Proposed Investment in 1994/95**  
**(\$ Million)**

<b>Programs</b>	<b>Research &amp; Development (R&amp;D)</b>	<b>Related Scientific Activities (RSA)</b>	<b>Total</b>	<b>Manpower Projections (person-years)</b>
Coal Technology	0.60	0.00	0.60	2.6 <sup>1</sup>
Hydrogen Research	1.00	0.00	1.00	4.4 <sup>1</sup>
Mineral Development	1.00	0.00	1.00	4.4 <sup>1</sup>
Alberta Geological Survey	0.00	1.37	1.37	5.9
Administration	0.00	0.65	0.65	8.1 <sup>2</sup>
<b>Total</b>	<b>2.60</b>	<b>2.02</b>	<b>4.62</b>	<b>25.4</b>

<sup>1</sup>Based on 60% of budget, @ \$75/hour for R & D professional an @ 1,840 person-hrs/year

<sup>2</sup>Based on 80% of budget, @ \$35/hour for administration staff and @ 1,840 person-hrs/year

The Department's proposed investment for 1994/95 is expected to support 17.3 person years of R&D and related scientific activity in various organizations and private companies in Alberta, in addition to 8.1 person years of professional and support staff within the Department.

During 1993/94, the funding contributions by all parties participating in projects that were partly funded by the Alberta government are shown in Table 9.9.3.

**Table 9.9.3**  
**Sources of Funds 1993/94**  
**(\$ Thousand)**

<b>Programs</b>	<b>A/Energy</b>	<b>Other Gov't.</b>	<b>Industry</b>	<b>Total</b>
Coal Technology	1,166	2,098	1,212	4,476
Hydrogen Research	1,048	359	882	4,289
Renewable Energy	625	35	17,000 <sup>1</sup>	17,660 <sup>1</sup>
Mineral Development	1,400	1,789	292	3,481
Alberta Geological Survey	1,368	0	0	1,368
<b>Total</b>	<b>5,607</b>	<b>4,281</b>	<b>21,386</b>	<b>31,274</b>

1. Includes expected capital costs for two wind farms to be raised by the private sector.

### **3. 1993/94 Manpower Allocations**

The manpower allocations associated with the 1993/94 funding contributions are shown in Table 9.9.4.

#### *Other Organizations Involved in the Department's Programs*

In addition to the funding provided by the Department, other organizations, predominantly industry, contribute to the Department's programs. These organizations are shown in Table 9.9.5.

Alberta Energy collaborates closely with the relevant government departments and agencies, universities, industry associations and individual private companies in the establishment of priorities and the development and funding of the following programs:

- Alberta Geological Survey
- Coal Technology
- Hydrogen Technology
- Renewable Energy Initiative
- Canada/Alberta Partnership on Minerals

It is recognized that Alberta has extensive renewable energy resources, and an active and supportive business community. This initiative provides an opportunity to demonstrate achievements to the world, and to transfer the new technologies. Technologies that are new, and technically and economically successful will provide one of the lowest cost energy in the world, either for use within the province or exported to other countries.

As a matter of principle, the Department of Energy does not provide funding for capital purchases in the coal and hydrogen research programs. This is done to avoid any issues arising over ownership. The department does provide funding for research and manpower components of projects, but requires that contractors provide funds for capital expenditures.

**Table 9.9.4**  
**Manpower Allocations 1993/94**  
**(Person-years)**

<b>Programs</b>	<b>Universities</b>	<b>Governments &amp; Agencies</b>	<b>Industry</b>	<b>Total</b>
Coal Technology	1.2	12.6	5.5	19.3
Hydrogen Research	0.7	1.9	8.1	10.7
Renewable Energy	0.0	0.4	5.3	5.7
Mineral Development	0.1	12.8	2.3	15.2
Alberta Geological Survey	0.0	5.9	0.0	5.9
<b>Total</b>	<b>2.0</b>	<b>33.6</b>	<b>21.2</b>	<b>56.8</b>



**Table 9.9.5**  
**Organizations Involved**

<b>Organizations Involved</b>	<b>Coal Technology</b>	<b>Hydrogen Research</b>	<b>Renewable Energy</b>	<b>Mineral Development (incl. A.G.S.)</b>
Alberta Chamber of Commerce	X	X		X
Alberta Geological Survey	X			X
Alberta Research Council	X	X	X	X
Alberta Oil Sands Technology and Research Authority	X	X		X
Canadian Electrical Association	X			
Geological Survey of Canada	X			X
Hydrogen Industry Council		X		
Industry	X	X	X	X
International Energy Agency	X			
Natural Resources Canada	X	X	X	X
The Coal Association of Canada	X			
Universities	X	X	X	X
Western Economic Diversification	X	X	X	X

## 9.9.5 Program Elements: Benefits and Impacts

### *Alberta Geological Survey*

The Alberta Geological Survey (AGS) is the custodian of mineral assessments and cores from mineral drilling in the province. The Survey plays a significant role in increasing the awareness of the potential for industrial and metallic mineral development, and is preparing a capability for a comprehensive information system.

Alberta's economy is greatly dependent on the earth's resources. Geoscience information is the key to exploration and development decision-making, environmental protection, and ensuring that the optimum benefits accrue to the province from its mineral resources.

The principal functions of the Alberta Geological Survey are: (1) to describe the geological framework of Alberta through mapping, modelling and analysis of raw data; (2) to conduct resource inventory and characterization through collection and synthesis of data; and (3) to manage archival geological data. In addition, the AGS provides geoscience information services to the public.

The information provided by the AGS to the various levels of government, industry and the general public allows the government to make informed resource policy decisions and encourage industry to focus appropriate on exploration and development.

### *Coal Technology*

The goals of the coal technology research program are:

- to minimize the environmental impact of coal production, transportation and use in Alberta and elsewhere, with particular emphasis given to global warming;
- to enhance the competitiveness of Alberta coals in domestic and international markets; and
- to develop new uses for Alberta coals.

The program priorities include emissions from fossil fuels and clean-coal technologies. The program stresses cost-sharing with the private sector and other governments. Specific topics being studied include CO<sub>2</sub> capture and disposal or use, Integrated Gasification Combined Cycle systems, NO<sub>x</sub> control, Full Fuel Cycle Emission Analysis, trace elements in coal, carbon fibres from coal, on-line analyzers and the suitability of Alberta coals for pulverized coal injection in blast furnaces. One technology is approaching commercialization: contaminated soil clean-up using the Alberta Research Council's coal/oil agglomeration process led by Thermodesign Engineering Ltd.

These activities will assist a viable and well-established coal industry to continue and possibly expand, while demonstrating that coal can be as environmentally acceptable as any other fossil fuel.

Approximately 2,350 people are employed directly by Alberta's coal producers, and up to 6,400 people are employed directly and indirectly by all aspects of an industry that

experienced estimated sales revenues of \$532 million in 1992. These revenues are derived partly from export sales and partly from the use of coal in Alberta to produce some of the least expensive electricity in Canada.

### *Hydrogen Technology*

The goals of Alberta Hydrogen Research Program (AHRP) are primarily expressed in research and development that aims to:

- protect and expand Alberta's petroleum industry by promoting technologies to upgrade the hydrogen-to-carbon ratio of Alberta's fossil fuels to meet present and future environmental requirements;
- diversify Alberta's economy by developing new commercial uses of hydrogen which will build on Alberta's resource industry and broaden the provincial industrial base; and
- increase the competitiveness of Alberta's industry by lowering the cost of hydrogen through new and more efficient hydrogen generation, transportation and use. Hydrogen is being used increasingly to upgrade crude oils and bitumen to produce transportation fuels, and the processes that use it are being continually improved to reduce production costs, improve productivity and meet market demand, i.e. reformulated gasolines. Although the addition of hydrogen converts bitumen valued at \$8 a barrel to synthetic crude oil valued at \$20 a barrel, less expensive, more efficient methods for producing hydrogen are needed by industry.

The current hydrogen research program is investigating advanced or alternative hydrogen production technologies, hydrogen separation technologies, large-volume hydrogen storage, transportation and distribution of hydrogen, optimum end-uses of hydrogen, and materials and safety technology.

The program is placing particular emphasis on the production of hydrogen from Alberta's abundant supplies of hydrogen sulphide contained in sour natural gas. If a commercial process can be found for dissociating hydrogen sulphide into its two components—hydrogen and sulphur—not only will two valuable commodities be produced from an otherwise hazardous chemical, but no other environmental emissions are likely to be formed as by-products.

The availability of lower-cost hydrogen will reduce the overall cost of producing ammonia, fertilizers, methanol and synthetic crude oil, thus making Alberta products more competitive in the national and international markets. Similarly, new uses of hydrogen, such as for producing hydrogen peroxide, will increase the number of value-added products that can be obtained from Alberta's natural gas resources.

Technology exists now to meet the need for modifying existing plant for the economic production of hydrogen at a commercial scale, and the possibility of transporting hydrogen by pipeline is being investigated. There are real prospects of the probability of successful commercial exploration of these new technologies.

It is worth noting that the industry has taken a lead role in pursuing these opportunities:



ASRL - H<sub>2</sub>S dissociation in modified Claus Plants, Syncrude and Imperial Oil - improved Hydrogen use in upgrading processes, Albchem - Hydrogen peroxide production for use in pulp and paper industry, and Praxair -Pilot Hydrogen pipeline system.

### *Southwest Alberta Renewable Energy Initiative*

In recognition of Alberta's abundant and virtually untapped renewable energy resources, the Southwest Alberta Renewable Energy Initiative is supporting the development of wind energy, solar energy and other renewable energy technologies in the Pincher Creek area of Alberta.

The purpose and goals of the initiatives are:

- in cooperation with industry, to develop environmentally acceptable renewable energy and energy conservation technologies suitable for Alberta's climate;
- to provide the renewable energy industry an opportunity to demonstrate the technical and economic viability of renewable energy technologies; and
- to support the economic diversification of the Pincher Creek/Crowsnest Pass area by encouraging local businesses to participate in the program and develop expertise in renewable energy technologies.

Since the Initiative began in 1989, the construction of wind farms to demonstrate various technologies and the reliability of using the wind to generate electricity has begun, and solar energy and small hydro projects have begun operating.

It is anticipated that the technologies being demonstrated in this program will be applicable throughout southern Alberta, and potentially in other parts of the province and Canada and abroad.

### *Canada/Alberta Partnership on Minerals*

More than 40 industrial minerals are believed to be present in Alberta, but 95 per cent of Alberta's mineral production comes from only four minerals: sulphur, limestone, sand and gravel. Together, these commodities contribute approximately \$600 million to Alberta's economy each year.

The objectives of the mineral development program funded jointly by the federal and Alberta governments are:

- to further develop Alberta's metallic and industrial minerals industries;
- to increase the productivity of these industries;
- to improve the quantity and availability of mineral-related geoscience data; and
- to replace imported minerals with locally mined minerals where possible.

The mineral development program aims to produce detailed regional maps and commodity profiles, and will undertake geological exploration to identify new metallic and industrial mineral deposits. Also, the program will develop recovery, extraction and processing technologies for existing and new operations. Associated with this activity is

the continuation of the current Alberta Geological Survey program in petroleum geology, basin analysis, coal geology and oil sands geology.

An improved understanding of the geologic environment, in combination with the development of mineral-related technologies, should open new opportunities for Alberta's energy and mineral industries and help make Alberta and Canada more self-sufficient in these resources.

To date, 36 geoscience, six technology-development and eight economic-development projects have been initiated. Reports from the geoscience and economic development projects are available to the public through the Institute of Sedimentary and Petroleum Geology (ISPG) in Calgary, and the Alberta Research Council Publications Office in Edmonton.

Significant, potential developments are the considerable interest by the industry in diamond exploration in the province, and Syncrude's and Gulf Canada's interest in the potential recovery of metallic minerals from Alberta's vast oilsands resources. Other early program results show good potential for minerals from brines, various industrial minerals as well as the potential recovery of fine gold from placer deposits in Alberta.

#### **9.9.6 Program Planning Process**

The research program planning and delivery process will be subject to the implementation of the restructuring of the Ministry and Department of Energy, which has been initiated in February 1994. All research activities within the Ministry are being consolidated in the new Oil Sands and Research Division. This new Division will include the two former agencies - Alberta Oil Sands Equity, AOSTRA, and the existing Branches within the Department - Non-Conventional Energy Development and Research and Technology.

An Energy Research Council will be established. It is expected to be comprised of private sector and Department senior executives who will set overall Research and Development Priorities and make appropriate recommendations of research activities and funding allocations for approval by the Minister.

The Division will then administer approved research and development projects in cooperation with research performing agencies and/or the private sector.

### **9.9.7 Evaluation**

Evaluation is an essential component of the program planning process. It documents the program's performance, provides recommendations and serves as a management tool to assist in future research programs. Commonly accepted evaluation criteria for a program are:

- objectives
- administration - structure and process
- project planning and control
- costs and benefits
- private sector perception
- information dissemination and use of results
- problem areas and potential improvements.

The findings of an independently conducted evaluation of the Alberta Coal Research Program in the latter half of 1988 have proven most useful in the planning and conduct of the program in subsequent years.

The Department has conducted further evaluations of recent program activities and will continue to do so. The need for additional evaluations by independent external contractors, which require substantial financial support, will be considered further when the restructuring of all research activities within the Ministry of Energy has been completed.



## **9.10 ALBERTA ENVIRONMENTAL PROTECTION**

### **9.10.1 Introduction**

Environmental protection and responsible management of the province's natural resources are critical in maintaining Albertan's quality of life and in supporting the province's economic development strategy. Research and related scientific activities are essential to the Alberta Environmental Protection in carrying out its protection and resource management mandate.

Alberta Environmental Protection is a department in transition. It has focused on consolidating and integrating the former departments of Forestry, Lands and Wildlife, Environment and the Parks component of Tourism, Parks and Recreation to enhance its service delivery. The new department has developed a vision, a mission statement and a set of operating principles and a new organization structure and is implementing a number of organizational changes in response to the Government's direction to adopt a new way of doing business.

A key part of the new organization is Research and Strategic Services, which has the responsibility of planning, prioritizing and integrating research needs across the new department.

The Alberta Environmental Centre, the provincial environmental applied research and laboratory services organization, which serves Environmental Protection, Agriculture, Food and Rural Development, Health and several other departments and agencies of government, now reports to the Assistant Deputy Minister of Research and Strategic Services. Two other organizations, which also undertake research and related scientific activities, report directly to the Minister (Alberta Environmental Research Trust and Alberta Special Waste Management Corporation).

Alberta Environmental Protection is currently preparing a three-year business plan. Research and related scientific activities are a key component of the new department's core businesses. The research and related scientific activities within the department will be redefined and streamlined as the business plan is finalized to ensure they support the department's core programs.

### **9.10.2 Mission**

Alberta Environmental Protection's mission reads:

"As proud stewards of Alberta's renewable natural resources, we will protect, enhance and ensure the wise use of our environment. We are a dedicated and committed team, responsible for managing those resources with Albertans. We are guided by a shared commitment to the environment and are accountable to our partners, the people of Alberta."

The new departmental operating principles are:

**Shared Responsibility**

All Albertans are responsible for ensuring the protection, improvement and wise use of our environment through their actions as individual citizens.

**Public Involvement**

Albertans will have every opportunity to understand and provide advice on decisions affecting our environment.

**Customer Service**

Albertans' trust in our stewardship of their renewable natural resources will be met with dedication, commitment, pride and excellence in service.

**Enforcement**

Albertans' expectations for environmental protection and enforcement are ensured by firmly and fairly enforcing our regulatory framework.

**Ecosystem Sustainability**

Alberta's ecosystems will be sustained through integrated resource planning, allocation, management and decision making.

**Scientific and Technical Leadership**

Albertans will continue to show international, scientific and technical leadership in research, technologies and environmental standards.

**Anticipation, Prevention and Mitigation**

Albertans are committed to protecting our environment by anticipating, preventing or mitigating environmental impacts of policies, programs, decisions and development activities.

**Intergovernmental Cooperation**

Albertans will work cooperatively with other governments to achieve environmental protection, enhancement and wise use of our natural resources.

**Environmental Enhancement**

Albertans are committed to the enhancement of our environment wherever possible to improve the quality of life now and in the future.

**Preserving and Protecting Special Places**

Albertans are committed to preserving and protecting special places that have historical, cultural and ecological significance.

**Sustainable Development**

Albertans are dedicated to achieving sustainable development that ensures the utilization of resources and the environment today does not impair prospects for their use by future generations.

### 9.10.3 Proposed Investment Level

Research and related scientific activities will be funded at lower levels over the coming three years, consistent with direction from the business plan and the government's deficit reduction strategy and goals. The exception will be with respect to the decision to permit the Alberta Environmental Centre to enter into revenue generating research partnerships. A suggested goal, to be confirmed in the business plan, is for the Centre to recover 15% of its expenditures from these external funding arrangements. A marketing effort to achieve this revenue is underway.

#### ENVIRONMENTAL PROTECTION

##### Estimated Investment Level

Fiscal Year 1994/95

\$ 000

Program	R&D	RSA	TOTAL
Air	1,334	1,497	2,831
Fish and Wildlife	92	885	977
Forestry	672	745	1,417
Land Information	0	16,507	16,507
Land Reclamation	3,916	1,351	5,267
Health	0	487	487
Water	1,685	6,629	8,314
Other	806	0	806
Total	8,505	28,101	36,606

The above noted estimates are subject to change as the department's business plan and expenditures reduction targets are finalized.

### 9.10.4 Organizations Involved

Departmental environmental research and related activities are accomplished in partnership with numerous collaborating agencies including; Environment Canada, Agriculture Canada, CANMET, Health and Welfare Canada, other provincial departments and the Alberta Research Council, municipal governments, industry associations, private companies and universities.

In most cases collaborators provide funding support, either directly or in-kind, to



departmental projects. Some research collaborators are funded by Alberta Environmental Protection.

#### **9.10.5 Key Program Elements**

##### **WATER AND WASTEWATER**

**Mission:** To provide collaborative applied research, analytical service and technical development projects to characterize and solve water pollution problems

This mission includes the water and wastewater analytical services, methods development for inorganic analytes in water, sediments and other environmental matrices (except soil), and laboratory, pilot and demonstration scale research projects on water and wastewater treatment technology.

##### *Wastewater Management*

##### **Activities:**

- A comprehensive study to completely characterize the immediate, short term and long term impact of biochemical oxygen demand constituents from pulp mill effluents on the surface water quality of receiving streams.

##### **Expected Impact(s):**

- Providing data on the long term decay of biodegradable organic constituents will assist river modelling consultants who are evaluating the short term and the long term impact of pulp mill effluents on the dissolved oxygen content of receiving waters downstream of existing and newly proposed pulp mills in Alberta. Existing and proposed new mills will be affected significantly.

##### **AIR AND WASTE MANAGEMENT**

**Mission:** To provide collaborative applied research, analytical service and technical development projects to characterize and solve air pollution and waste management problems

This mission includes the air analytical services for both point sources and ambient samples, methods development for contaminants in air and flue gas matrices, and laboratory, pilot and demonstration scale research projects on biological, chemical, physical and thermal waste treatment technology. The microbiological analytical services for environmental samples containing bacteria and fungi are also provided by this mission.

## *Air Analytical Services*

### Activities:

- Ambient air and source emission samples collected province-wide by the Alberta Environmental Protection continue to be analyzed at the Alberta Environmental Centre. The sampling network includes fixed monitoring stations in urban and industrial areas. Air samples are collected and analyzed for complaint and investigation purposes.

### Expected Impact(s):

- By providing a state-of-the-art analytical service the Centre plays a key role as backup to the regulatory services which ensure that the province's air quality continues to meet high standards and that all industries in the province comply with their licence requirements.

## *Incineration*

### Activities:

- Further progress was made in sampling and analytical methods development for the measurement of trace organics in flue gases, including investigation of the effect of hydrochloric acid. Dioxin and furan analytical procedures were added to the laboratory's capabilities.
- The quality assurance method used at the Alberta Special Waste Treatment Centre was further developed at the Alberta Environmental Centre so that it can now be used as a regulatory tool for proving that licence requirements are complied with.

### Expected Impact(s):

- Sound waste management practices will be developed by evaluating different strategies including incineration, solidification, composting and others and ensuring that emissions from these are minimized and understood.

## *Microbiology*

### Activities:

- The Centre's microbiological analytical services continuing to be used by many external and internal clients are identification, toxicity testing and quantification of microbial populations in waters, soils and wastewaters.
- Research on microbiological processes in waste management involves experimental work on chromium removal from industrial wastes using bioreactors, performance assessment of on-site domestic wastewater treatment technology, and the detection and quantification of odorous compounds of microbial origin associated with piggery waste.

#### **Expected Impact(s):**

- Support will be provided to Alberta Environmental Protection and Agriculture in the identification, enumeration, and toxicity assessment areas.
- Develop, evaluate and transfer the technology of promising processes, eg. biofilter, resource recovery from gypsum, pig waste odour control and white-rot fungi applications, to industry.

#### **TRACE ANALYSIS**

**Mission:** To provide collaborative applied research, analytical service and technical development projects to characterize and measure trace organic components of environmental samples

This mission includes the extraction, concentration and analysis of trace organic components in environmental samples, particularly the organic priority pollutants, PCBs, pesticides and many chlorinated compounds. Methods development for organic contaminants in new matrices and research projects on the environmental fate of organic contaminants, and the environmental isotope analytical service, and research projects associated with it, are also included in this mission.

##### *Environmental Isotopes*

#### **Activities:**

- Continuing work on environmental, general earth sciences or other problems requiring geochemical isotopic techniques.
- Maintain effective C-14 and H-3 analytical capability as principal research tools.
- Utilize stable isotope analyses for projects.

#### **Expected Impact(s):**

- Investigate and solve the following problems:  
origins and solutions to soil salinity problems, aquifer characterization, wastewater contamination vectors, sulphur sources in acid deposition, erosion rates, basin source water, assistance in preservation of our national heritage by analysis of archaeological specimens at the Old Man River Dam reservoir, and the International Heritage Site at Head-Smashed-In Buffalo Jump.

##### *Organics - Regulatory*

#### **Activities:**

- Continue support to client groups (primarily Alberta Environmental Protection) in their regulatory, monitoring and environmental emergency roles.
- Continue to provide consultation and advice on analysis of organics, and related technical issues.



### **Expected Impact(s):**

- Contribute to the continuation of good health of Albertans through regular and systematic analysis of drinking water throughout the entire province.
- Ensuring that enforcement of new environmental legislation is possible, through continued development and enhancement of analytical tests.
- Understanding of fate and effect processes of chemicals associated with pulp mills discharging effluents in northern Alberta River systems.

### **PEST MANAGEMENT**

**Mission:** To provide collaborative applied research, analytical service and technical development projects to characterize the impact of pests and pest management practices on the environment and to develop safe and economically acceptable pest management practices

This mission includes the diagnostic, advisory and field investigation services for problems relating to pest management practices. Field and controlled-environment research projects designed to reduce the use of pesticides, and their environmental impact, by using biocontrol agents and alternate cultural practices are also included.

### **Activities:**

- On-going and timely diagnostic and advisory services will be provided in insect pests, plant diseases, weeds, and chemical damage to crops and other vegetation to agricultural producers and the public at large. The pesticide chemical damage service provided by AEC is the only one in western Canada.
- Research in the area of weed ecology has lead to the development of a computer program based on the mathematical models developed for estimating crop yield losses due to one or two weeds. Research is continuing to develop more mathematical models that will apply to other weeds that result in crop yield losses.
- Research on the biological control of weeds with insects that are natural enemies (parasites or predators) of the target weed in environmentally sensitive areas will continue. Early results are very encouraging. For example, a root-feeding beetle is well established on hundreds of sites in Alberta to control leafy spurge.

### **Expected Benefits:**

- The pest diagnostic service has contributed and will continue to contribute to saving millions of dollars from pest damage to crops. (For example, surveys, monitoring and prevention for diseases like blackleg of canola will save the canola producers millions of dollars in crop losses from this devastating disease. As a result of the diagnosis provided to Alberta farmers, most claims for damages are now settled out-of-court. The use of the computer program for crop loss estimation has helped farmers reduce herbicide use in the prairie provinces by 15% or more. In Alberta this translates to reduced input costs of approximately \$20 million annually.)
- Development of cost effective methods for rehabilitation of soil sterilant affected sites and oil and gas well leases will immediately benefit the energy industry and the

farming community.

- Use of biocontrol techniques is both economical and environmentally safe compared to chemical control.
- Research on ecological approaches to weed management will continue with emphasis on cultural practices such as reducing the impact of weeds on crops by increasing crop seeding rates and decreasing row spacing.

## ENVIRONMENTAL TOXICOLOGY

**Mission:** To provide collaborative applied research, analytical service and technical development projects to characterize the effects and assess the risks of chemical and physical environmental changes in animals, including man

This mission includes research projects to assess the acute and chronic toxic effects of chemical and physical environmental changes using experimental animals, cell cultures and biochemical systems. Biochemistry, clinical chemistry, pathology and electron and light microscopy services are also included. Field investigations essential to relating laboratory and real life situations are undertaken. Expert advice on risk and risk analysis resulting from environmental exposure to complex mixtures is also provided. Regulatory bioassays are performed for legal and compliance purposes.

### *Toxicology of Petrochemicals*

#### Activities:

- Conduct several in-depth veterinary toxicology field investigations into possible environmental contamination of livestock.
- Provide expert advice in veterinary toxicology on possible adverse health effects in livestock associated with the petroleum industry to the Energy Resources Conservation Board.
- Conduct research on diagnostic biomarkers of crude oil exposure and oil-field chemical exposure in cattle.

#### Expected Impact(s):

- Provide the appropriate expert advice for setting new regulations and standards (e.g. for pulp mills, new industries, waste management and disposal practices) to the legislative bodies involved in licensing, monitoring, enforcement and prosecution; provide expert witnesses for both government and civil court cases, public hearings and governmental panels; assist in the evaluation of Environmental Impact Assessments (EIAs).
- Extending Alberta Environmental Protection's analytical capability to include heavy metals quantitation in plant and animal tissues as well as biological fluids permits new research to be conducted on environmental pathways for contaminant movement in the ecosystem which is of importance to regulators and licensors.

## ENVIRONMENTAL ENHANCEMENT

**Mission:** To provide collaborative applied research, analytical service and technical development projects to characterize and develop means of protecting ecosystems and restoring disturbed, degraded and contaminated habitats

This mission provides expert advice and technical assistance on soil reclamation, revegetation of disturbed sites, wildlife and aquatic ecology. Field and laboratory research projects on soil degradation and its impact on plant communities, contaminated soil reclamation, the impact of forestry practices on wildlife and the impact of water management practices on aquatic ecosystems are also included. The development of native plants for revegetating disturbed lands is a key component of this mission.

### *Soil, Vegetation and Wildlife and Aquatic Ecology*

#### **Activities:**

- Provide diagnostic and advisory services in aquatic biology/toxicology, wildlife biology and soil reclamation to our clients (mainly government agencies).
- Field operation of a Bio-Reactor capable of testing the optimal conditions for rapid degradation of petroleum contaminants in soil.
- Continue method development of aggregating oil-contaminated soil to optimize biodegradation of hydrocarbons and leaching of salts.

#### **Expected Impact(s):**

- Dependable monitoring of the impact of industrial activities (such as river dams, pulp mills) on aquatic habitats.
- Determining that fish in the Oldman River Dam Reservoir are safe for human consumption.
- Selected lines of native grasses will be available commercially for land reclamation, soil conservation and renewing wildlife habitat.
- Biodiversity data will be one of the important contributions to economically acceptable management of natural resources, i.e. forests, wildlife.
- Ability to reduce the impact of forest harvesting activities on soil and to reclaim the degraded soil will support the multi-billion dollar industry in Alberta.
- Economic, efficient and environmentally safe technology i.e. Bio-Reactor and SESA, will be available to support the gas and petroleum industry in Alberta.
- Complete quantitation of the total and organic fraction of mercury in fish tissue is available to ecosystem researchers and fish monitoring agencies within the Government of Alberta.



## 9.11 ALBERTA HEALTH

### 9.11.1 Background

Health services are provided through 27 public health units, almost 300 hospitals and long term care facilities which are operated by autonomous boards, and 56 mental health clinics, in addition to thousands of private practice health professionals. These health services are provided by a broad spectrum of health professionals including physicians, nurses, physiotherapists, optometrists, and other health professionals.

Health research, with a particular focus on health services research and innovation, will contribute to improving the effectiveness of health services in the province and ultimately contribute to the improved health of Albertans. A wide array of research will be supported that improves the quality of life of individuals and which examines the cost-effectiveness of providing a service or intervention that minimizes the current financial burden on the health system. Health research that examines high volume and costly services or interventions and those with uncertain efficacy are of primary interest to the department.

Albertans will benefit directly as a result of the research conducted by way of improvements in service delivery, quality of care individuals receive, and by new approaches and treatments. Individuals will also benefit directly, by the alleviation of pain and suffering and by improvements in family and community well-being.

#### *The Planning Process*

A number of mechanisms have been employed to develop a health research agenda for the Province. Major health reviews such as the Rainbow Report and An Agenda for Action advocate that the setting of research priorities for health research and technology assessment should come from multiple sources, including provincial and national experts. This view led to the creation of the Provincial Advisory Committee on Health Research (PACHR), which was established by Ministerial Order in August 1992. The Committee reflects research expertise in epidemiology, nursing, medicine, economics, social sciences, public health, and administration, in order to address the multi-disciplinary and complex nature of health research.

PACHR reports to and advises the Minister of Health on matters relating to health services research and technology assessment, and selects research projects for funding under the auspices of the Health Services Research and Innovation Fund. The Fund focuses on health outcomes and the effectiveness of health services.

Representation on the Technology and Research Advisory Committee (TRAC) and chairing the TRAC Subcommittee on Health Research, has also allowed Alberta Health to become more involved in the co-ordination of government sponsored health research. Additionally, the department has established a special health technology assessment implementation committee to liaise with the health sectors, industry and the Alberta Research Council. The department also supports conferences and workshops to bring

academic staff and health sector administrators together to identify priority research questions and find the means for supporting related studies.

### **9.11.2 Department Objectives**

The overall mission of Alberta Health is to promote, maintain, and improve the health of Albertans, by providing direction in the management of resources and ensuring appropriate, accessible and affordable health services in the province. The mission statement has a dual focus: population/people health and management of the system.

The vision for the health system in Alberta incorporates the following:

- The future of the health system in Alberta will be one in which the commonly held principles of health care which Albertans cherish will be strengthened and enhanced.
- Health practitioners and administrators will strive to keep Albertans healthy and independent in their own homes and communities for as long as possible, yet have reasonable access to leading edge technology, medical procedures, professional expertise and drugs whenever treatment is required.
- The health system will be better managed and adequately funded.
- All health professionals and organizations will work together in a spirit of co-operation and collaboration. Hospitals, health units, long-term care facilities, mental health clinics, health service providers, and volunteer organizations will provide a continuum of high quality health services.

The strategic directions deemed necessary to achieve Alberta Health's mission and the vision for the health system are as follows:

#### **1. Effectiveness**

Providing an appropriate, affordable health care system depends on accountability at all levels. Quality programs and services delivered or funded by Alberta Health should be effective and contribute to improved health for Albertans. Effectiveness requires the monitoring and evaluation of health outcomes.

#### **2. Access to Health Services Continuum**

Health services must be accessible and offer appropriate choices along the spectrum of services. The spectrum includes illness prevention, protection, health promotion, care, rehabilitative and supportive services. A transition from in-patient institutional programs to ambulatory services and community based programs is supported. In order to achieve equity of access to health services, resources will be targeted at those individuals and groups less capable of helping themselves.

### 3. Health Promotion and Disease/Injury Prevention

Awareness and understanding of how to remain healthy and improve our health are essential. Healthy lifestyle decisions regarding physical, emotional and mental health will be encouraged.

### 4. Fiscal Resource Management

The future of Alberta's health system depends on more effective management of fiscal resources. Limits on health care expenditures allow increased attention to other health determinants such as education, housing, employment and the environment.

### 5. Human Resource Management

Health human resources significantly influence the quality and accessibility of health services, and the expenditure of available funds. Health workforce planning must be based on population health needs. Collaboration with employer organizations, unions, professional associations, educators and other Government departments is essential to provide cost-effective, quality services.

### 6. Health System Organization

The way the health system is organized to provide services affects the quality, accessibility and cost of services. The organization of the health system is being reviewed to address fragmentation, duplication and gaps in services, and to improve efficiency and affordability. Better planning, improved coordination and restructuring of the health system will be considered.

### 7. Communication

Communicating information and key messages to the public, stakeholders, Alberta Health staff, and the media is even more important as the health system proceeds through restructuring and reform. For Albertans to be a part of the process, they must be well-informed about how our health system works, its costs, and options for change. Communications must be two-way, and the lines of communication broadened among stakeholders and government. The media will be a primary avenue of communication, so we must build effective relationships with the media and improve their access to information and department/government messages.

The health research objectives are as follows:

- to set priorities for health research, in particular health services research and innovation and technology assessment, that are useful to policy formulation and program development, and to periodically review these priorities.
- to set and operate according to all necessary protocols, procedures and criteria, including ethical reviews, when evaluating health services research and innovation proposals.



- to develop, and operate in alignment with, criteria for the assessment of health technologies, in consultation with appropriate national bodies and other external representatives.
- to inventory health services research and technology assessment projects and findings, disseminate the information and, where appropriate, incorporate it into policy and practice.
- to measure the results, appropriateness, relevance, acceptance, responsiveness, secondary impacts, and costs of the health system and make decisions on the basis of the findings.
- in conjunction with the Alberta Heritage Foundation for Medical Research (AHFMR) the Provincial Advisory Committee on Health Research (PACHR), and community health practitioners, develop provincial in-service and intramural training for conducting health services research in order to enhance the effectiveness and efficiency of health services.

### 9.11.3 PROPOSED INVESTMENT LEVEL (\$ MILLION) 1994/95\*

	R & D	RSA	Total
<b>EXTRAMURAL</b>			
Alberta Mental Health Research Fund	0.66	-	0.66
Health Services Research & Innovation Fund	0.70	0.10	0.80
Applied Cancer Research Program	2.80	-	2.80
Other Studies	0.05	0.55	0.60
<b>INTRAMURAL</b>			
Administration	0.17	0.69	0.86
Administration of Extramural	0.13	0.04	0.17
<b>Total:</b>	<b>4.51</b>	<b>1.38</b>	<b>5.89</b>

\* These are budget estimates based on the 1993/94 budget.

\*\* The budget estimates are essentially the same as last year's estimates but will be adjusted when the business plans are finalized. Reductions in the overall Department budgets are expected to be reflected in the overall R&D investment levels.

#### **9.11.4 Coordinating Mechanisms and Organizations Involved**

Alberta Health works in partnership with health practitioners, professional associations, health units, hospitals, agencies, universities, and other interested groups to ensure a coordinated approach to the delivery of health services. The involvement of the universities, hospitals and health units is vital to ensure a coordinated approach to the conduct of health services research. Infrastructure support is provided by the universities and hospitals. They have the necessary and complementary resources crucial to the success of this initiative. While Alberta Health may focus on the development of a health services research agenda and provide some financial support, as well access in accordance with confidentiality provisions to data bases, the other stakeholders provide technical, clinical and research expertise and field settings for the conduct of this research. Also, through the collaboration of health service providers, researchers, and the department, greater emphasis will be placed upon determining the effectiveness of the structures, resources, programs and treatment choices by examining health care outcomes. Linkages have also been established by Alberta Health at both the federal and interprovincial level.

The level of involvement by other departments, agencies, federal departments and industry has been substantial. Investigators and researchers have been successful in attracting research dollars and support by working collaboratively with a number of organizations including the Canadian Cancer Society, pharmaceutical companies, the Northern Alberta Brain Injury Society, the National Health Research and Development Program, the Medical Research Council, the National Sciences and Engineering Research Council, and the United States Army Directorate of Health Care Studies.

Links to the other western provincial departments of health have been established to identify common research interests and explore ways to collaborate in the conduct of health services research.

Alberta Health in collaboration with the University of Alberta and the Alberta Heritage Foundation for Medical Research is currently identifying the key players in health services research in the province, priorities and opportunities for collaboration in Alberta and across the Western provinces.

#### **9.11.5 Key Program Elements**

##### **Applied Cancer Research Program**

This program supports clinical and basic research projects in four major categories which include collaborative research projects between clinical and basic scientists; support for multi-user facilities such as magnetic resonance imaging facilities for research; industry/oncology fellowship grants; and core support for clinical research projects. The projects funded in these four categories may involve prevention, screening, diagnosis or treatment for cancer.

Cancer research is an integral part of treatment and the projects funded last year include studies in the area of tumour radiosensitivity with oxygen, genetic or familial cancer-

prone conditions, and new strategies in chemotherapy.

In addition to the \$2.8 million provided by the Alberta Heritage Savings Trust Fund for applied cancer research, the Alberta Cancer Board and their research scientists were successful in attracting research dollars from a variety of sources including the Canadian Cancer Society, National Cancer Institute of Canada, pharmaceutical companies and industry. The approximate total amount of research dollars from these sources is \$3.5 million/year.

### *Planning Process*

Every five years a strategic plan is developed for the Alberta Cancer Board Program, based on a review of accomplishments demonstrating the effectiveness of the program. The review process includes the involvement of a variety of members consisting of representation from the Advisory Committee on Research, the Alberta Cancer Board research community, Faculty of Medicine, Alberta Heritage Foundation of Medical Research (AHFMR), National Cancer Institute of Canada, Canadian Cancer Society and Alberta Health. Coordination with other departments or agencies is done through the circulation of an Annual Report, review by the Alberta Heritage Savings Trust Fund Standing Committee of the Legislature and through coordination with PACHR and TRAC.

### *Accomplishments*

An advancement in the treatment of breast cancer as a direct result of research is the introduction of the breast screening program in Alberta. Other advances include the use of tamoxifen and new radiation therapies.

There are strong expectations that the A-T gene, which confers a predisposition to breast cancer and possibly other cancers, and the BRCA-1 gene will be found in the near future based on research underway.

Other advancements not specifically related to breast cancer include shifting cancer care to an outpatient setting through symptom control and revised treatment practices, particularly in pain control. An example of a new invention is the inexpensive self-administered intravenous injector which enables patients to remain in their homes.

### **Mental Health Research Fund**

- The Mental Health Research Fund supports mental health researchers in the province with the objective of promoting mental health research and practitioner training to conduct research.
- The focus of the Fund will be broadened in 1994/95 to include health services research submissions. This is defined as studies designed to improve the mental health of Albertans through examination of the functioning of the mental health system.
- Funding is awarded in support of basic, clinical and health services research that is



focused on issues relevant to mental health.

- The fund recently supported the establishment of a research unit at the University of Calgary to investigate developmentally disabled children and explore causes of learning and attention disorders, including genetic studies of children with dyslexia.
- Previous grants have supported studies examining the biochemical causes of depression and schizophrenia, as well as different treatment modalities for various mental illnesses.
- Researchers funded by the Mental Health Research Fund also obtain support from a variety of national research bodies and industry.

### *Accomplishments*

Some AMHRF grant studies have recently reported on the outcomes of the research. Some of the notable outcomes identified were advances in the areas of pharmacotherapy of depression and panic disorder, Tourette's syndrome and attention deficit disorders. Additional research has led to the development of a potentially effective new treatment for stimulant addiction and schizophrenia, and has led to the filing of drug patents in both Canada and the United States.

### **Health Services Research and Innovation Fund (HSRIF)**

Now in its second full year of operation, the Health Services Research and Innovation Fund has modified its criteria to focus more specifically on health services outcomes in terms of effectiveness of health services. The Fund will support well designed and conducted research that will help improve the development, organization, and delivery of health services. Proposals must employ definable and measurable health outcomes. Those projects that enhance the quality of life and have the potential for cost stabilization or savings will be favoured.

All HSRIF applications are reviewed for scientific merit by a committee of peers. Each application is reviewed by two committee members who provide written reports. Each application is then discussed by the committee members until a consensus is reached on the scientific merit.

This process is repeated during the second stage of the competition. Additionally, each proposal is reviewed by two external referees for intrinsic scientific merit and significance of the proposed research within the particular field of study from a national/international perspective.

### *Expansion to Program*

A new category of application has been added this year to complement the research grants in the 1993/94 HSRIF competition, the application for formulation grants. These are small grants intended to assist individuals with good ideas but, who have a limited research background or experience to develop sound research proposals.

### *Accomplishments*

The Fund has recently provided support to projects such as an effectiveness study of a cancer prevention program, a demonstration project that is an innovative and a cost effective way to provide educational and support services to care-givers of brain injury survivors, the development of a more cost efficient way of treating a frequently diagnosed sleeping disorder, and the economic cost of health system inefficiency in specific health care sectors.

It is expected that the findings generated as a result of these projects will help improve the organization and delivery of health services, promote cost efficiency and effectiveness, and improve health outcomes for Albertans.

All HSRIF projects must have a built in evaluation component to determine the effectiveness of the projects, and evaluation procedures must also be acceptable to external reviewers of the proposals. As the Fund program matures, an evaluation will be conducted to ensure the effectiveness of the program.

### *Contribution to the Economy*

It is also anticipated that these projects will contribute 10 jobs to the provincial economy in 1993/94, ranging from research assistants to data entry operators, and an additional 7.5 jobs in 1994/95. The social impact and health cost savings generated as a result of these research projects are expected to be significant and are anticipated to increase the quality of life for Albertans.

#### **9.11.6 Expected Impact**

The research investments made by the department will lead to the development of a) systems (organizational structures, resources, techniques) required to assess the outcomes of health care in terms of effectiveness and efficiency; and b) knowledge about the impact of various reimbursement, organization and delivery systems on access and quality of care in health services. This will ensure the continuing development of sound management practices and will ensure policy decisions are based on the best available information.

In addition, the application of new knowledge, practices and medication combined with education on health promotion, will improve the quality of care to individual Albertans, improve family and community well-being and reduce the pressures on escalating health costs.

The health research organizational arrangements enable the Minister of Health to have direct input into the health research agenda and to draw upon health services research findings and expertise in policy formulation and program planning. Health services research, principally dealing with issues of effective and appropriate health program delivery is placed within the overall context of all health research, including biomedical research. Direct costs savings to government through the application of research findings

to the various treatment procedures and administrative practices will accrue. Additionally, maintenance and improvement of the health of Albertans has cost benefits for families and employers.



## **9.12 ALBERTA LABOUR**

### **9.12.1 Background**

Alberta has one of the best workplace health and safety records in Canada. Alberta's lost-time claim rate is one of the lowest in the country. Over the past decade the injury rate has declined substantially. In 1981 one out of every 15 workers was injured on the job (a rate of 6.7 per 100 workers), while in 1992, one out of every 26 workers was injured (a rate of 3.9 per 100 workers).

In spite of the intensive efforts by industry and Government, each year more than 33,000 Albertans sustain workplace injuries, and about 100 work-related fatalities occur.

During the past several decades there have been significant changes in the workplace, coincident with the diversification from an agricultural-based work force. Industries are expanding, and processes are being mechanized. The hazards and control procedures change as new work procedures are introduced.

The number of job changes in a career span is increasing, exposing more workers to unfamiliar conditions. New workers (those with less than six months on the job) have a higher risk of injury than other workers.

Workers are exposed to a wider variety of chemicals. New chemicals are introduced and their long term health effects may not be known. Recycling and disposal of hazardous wastes add to safety concerns in the workplace.

The public is showing much less tolerance towards unsafe workplaces and work practices. Some organizations have achieved sustained periods of no lost-time claims, but these are exceptions. The injury-free workplace is far from being assured.

### **9.12.2 The Department's Objectives**

Research conducted or funded by Alberta Labour is concentrated in the area of occupational health and safety. It is designed to improve the health and safety of Alberta's workers, and to achieve healthier and safer work environments. Leadership is required by Government in setting standards and ensuring advanced safety practices are developed and applied.

Internal research is directed toward improved identification of occupational risks, and the development and evaluation of prevention strategies. Research information and advice are communicated to employers, workers and researchers.

The Occupational Health and Safety Heritage Grant Program supports educational, research and conference activities aimed at preventing occupational injuries and illnesses, and promoting the health and well being of Alberta workers. The Occupational Health and Safety Heritage Grant Program provides funding to employer and worker organizations and to post secondary institutions. The program's emphasis is placed on

funding applied research that is directed towards solving high priority occupational health and safety problems. In 1993/94, increased emphasis was placed on seed funding for industry safety associations.

### 9.12.3 Proposed Investment Level

Alberta Labour has proposed to invest \$360,000 in R&D and RSA in 1994/95 as shown in Table 9.12.1. This represents 0.08% of the cost of WCB claims made on behalf of industry for workplace injuries and illnesses.

TABLE 9.12.1 S&T INVESTMENTS

Investments	1992/93 ACTUAL			1993/94 ESTIMATED			1994/95 PROPOSED		
	RSA	R&D	TOTAL	RSA	R&D	TOTAL	RSA	R&D	TOTAL
Universities	0	280	280	0	160	160	0	160	160
Industry	0	0	0	0	50	50	0	50	50
Other	0	40	40	0	0	0	0	0	0
Internal	140	120	260	110	40	150	110	40	150
<b>TOTALS</b>	<b>140</b>	<b>440</b>	<b>580</b>	<b>110</b>	<b>250</b>	<b>360</b>	<b>110</b>	<b>250</b>	<b>360</b>

**Note:** The investment levels presented here for 1993/94 are lower than those presented in last year's report. This results in part from a more rigorous adherence to the survey's definition of research, to exclude most operational planning and policy development activities.

The grant program began in 1981. Its overall objectives are set by senior management in consultation with the WCB and other interested parties. A steering committee, with representatives from several government departments, labour and the public, makes recommendations on individual applications for funds. The program is funded on a year-to-year basis.

### 9.12.4 Organizations Involved

Educational institutions have received 55% of the funds of the Heritage Grant Program since the program started. Employer/industry associations and individual companies make up the majority of the remaining recipients.

About 40% of research projects funded by the program have received additional funding from other sources. The co-funding from industry and other organizations has taken many different forms, from cash funding to donating time and expertise. In recent years, for every grant dollar awarded, industry, the federal government, and other government departments contributed 56 cents towards grant projects. Proposals indicating a commitment of co-funding from industry are preferred by the Heritage Grant Program.

Several internal research projects use data collected by the WCB. Meetings are held throughout the year with staff from both organizations to ensure that the data are relevant to research projects. Several meetings were also held this past year with staff from Alberta Health on the feasibility of obtaining information on occupational illness and injuries.

#### **9.12.5 Key Program Elements**

##### *Internal Research*

Examples of research conducted by the Department are described below.

- The contribution of workplace and workforce characteristics to the incidence of injuries and ill health are studied. For example, the evaluation of injury risk in relation to age and job experience is used to develop prevention programs which reflect workers' characteristics and needs.
- Statistical studies estimate the risk of injury for specific occupational groups and examine the type of injuries likely to occur. This kind of analysis focuses the Department's efforts in working with industry and labour to reduce injuries.
- Testing of The Work Site Index is progressing. It is a survey instrument designed to assess the quality of health and safety at work sites in Alberta.
- Epidemiological research, such as studying noise exposure of Alberta workers, helps to prevent future occupational illness.
- Program evaluations focus and improve the Department's programs and services. For example, the "Partnerships" program has been evaluated. (In the "Partnerships" program, industry associations help employers establish custom health and safety programs, with guidance provided by Alberta Labour.)
- Hygiene field studies collect information on occupational exposures and determine whether revisions to occupational exposure limits, included in Regulations, are needed.
- New laboratory methods are being developed to better detect potentially harmful substances which affect the health of workers.
- Technical surveys of ergonomic risks are conducted at Alberta work sites.

##### *External Research*

Current funding priorities of the Heritage Grant Program include:

- fatal and serious injury events
- small business
- chemical and biological hazards



- hazards in the oil and gas industry
- hazards in the forest industry
- initiatives for young/new workers
- initiatives related to literacy/English as a second language
- Research projects recently approved or completed include:
- A study on the removal of pesticide residue in clothing (\$96,500)
- Research to model the dispersion of dense toxic gases near buildings (\$43,000)
- Research on the electrostatic hazards of clothing (\$140,000)
- Further analysis of the data on the impacts of alcohol and drugs in the workplace (\$40,000)

#### **9.12.6 Evaluations**

Both internal and external research activities have been evaluated through the strategic and operational planning process carried out by the Department. The Heritage Grant Program is also reviewed annually by a committee of the Legislature.

The Heritage Grant Program was subject to formal, external evaluations in 1986 and 1991. The 1986 evaluation consultants, T.D. Weiden and Associates Ltd., surveyed a sample of grant applicants, grant recipients, members of the grant steering committee, Departmental staff and other stakeholders. Proposal files were also coded on a large number of variables.

The 1986 evaluation concluded that the grant program has played a major role in:

- stimulating non-government sectors to take action to improve workplace health and safety
- establishing permanent programs in industry, labour and educational institutions to address occupational health and safety concerns
- developing new strategies and materials to prevent work-related illnesses and injuries
- increasing the numbers and expertise of individuals trained in occupational health and safety.

The evaluation conducted by Ernst and Young Management Consultants in 1991 comprised extensive interviews with a wide range of people. The evaluation team canvassed the opinions of a sample of external and internal stakeholders, grant program recipients, companies and organizations which had used the results of funded projects, and workers in industries related to projects.

The external stakeholders came from employer, labour or academic backgrounds and were generally in executive positions. They were interviewed on issues and trends in occupational health and safety, as well as the impact and role of the grant program. The evaluators asked grant recipients to assess the impacts and results of funded projects. Recipients also gave their own views on the future of the program.

Interviews with project users were used to see whether their views on the impacts and results of projects were consistent with grant recipients' views. Comments from workers from industries related to four projects determined whether workers considered them to be beneficial. In addition to the interviews, Ernst and Young reviewed similar programs in four other provinces.

The 1991 evaluation found that the program's major strengths were flexibility, leverage for Alberta Labour, and usable results. As an example of the latter strength, it was noted that a funded research project developed procedures to systematically evaluate flame resistant protective clothing. This included the development of the only independent thermal mannequin available in the world. It has been used by companies in Alberta and elsewhere in North America. In addition, the Canadian Association of Petroleum Producers has developed voluntary standards for flame resistant clothing for workers as a result of this grant program research.

#### **9.12.7 Accomplishments**

The number of lost-time claims (LTCs) recorded by the WCB dropped from 37,700 in 1991 to 33,500 in 1992. The LTC rate fell from 4.4 LTCs per 100 person years in 1991 to 3.9 in 1992. At an average direct cost of \$14,200 per claim, the reduction in injuries and illnesses resulted in a direct savings of over \$59 million. Many factors undoubtedly led to this substantial improvement. The savings attributed to the Heritage Grant Program research are estimated to have been \$1.2 million.

Other benefits of improved occupational health and safety are: increases in productivity, and decreases in pain, suffering and health care costs.

## **9.13 ALBERTA TRANSPORTATION AND UTILITIES**

### **9.13.1 Background**

Alberta has an exceptionally well developed transportation system including 13,000 km of primary highways, 15,000 km of secondary highways and 125,000 km of local roads. Responsibility for the management of this system resides with Alberta Transportation and Utilities (AT&U), through five regional offices and fifteen districts, strategically located throughout the province. AT&U has a stronger operational function than most Alberta Government departments, and this is reflected in the close ties between its research and operational activities. Alberta's economy is highly dependent on its transportation system, which is accentuated by the long distance to major markets. The value of goods moved over the system is estimated to be \$28 billion annually. The tourism industry, with annual revenues of \$3 billion, also depends heavily on effective efficient transportation.

Research has impacted operational activities and produced considerable cost benefits, some examples are:

- Introduction of sixteen expert system prototypes applicable to highway design, operation and maintenance promise to show savings to the department of some \$2,000,000 annually.
- Research that has been carried out into use of superplasticizers and fly ash in concrete is currently being incorporated into specifications and standards. When completed, the increased concrete strength and durability will extend the service life of bridge structures and reduce repair and rehabilitation costs. Anticipated savings are \$1,000,000 annually.
- Continued research into control of wildlife along highways is being conducted. It is estimated that the cost to society of vehicle collisions attributable to wildlife is \$420,000,000 annually in Alberta. Even one percent reduction in collisions would save the Alberta taxpayer over \$4,000,000 yearly.
- A system has been developed to automatically download to a remote location the weight of gravel in haul trucks, thus eliminating the need on various pavement construction jobs for an operator at the weigh scale and a checker's interaction with the truck. Checkers have frequently been struck by trucks. Not only is safety greatly increased for the checker, but elimination of the weigh scale operator on each job will save at least \$2,500,000 annually.
- An evaluation of the use of compressed natural gas on departmental fleet vehicles was conducted. The results showed saving of 26% in fuel costs relative to gasoline, significantly reduced exhaust emissions and a payback for the conversion costs in four years based on yearly travel of 20,000 km.
- Development of satellite surveying techniques for establishing ground control for



aerial photography has shown manpower cost savings of \$4,000 per project. Based on 50 projects the expected return will be \$200,000 yearly.

### **9.13.2 Department Objectives**

- Enhance departmental capability and use of internal resources - through effective teamwork and internal communication, business and human resource plans, effective planning cycles and processes, staff development and career planning, implementation of new technologies and systems, and effective land management.
- Protect the public's investment in infrastructure - through long term plans for maintenance and rehabilitation of bridges and pavements, including utilization of better performing and longer lasting materials.
- Improve the department's effectiveness in meeting public needs - through ensuring effective partnerships, continued paving of the secondary highway systems within budget limitations, effective planning, programming and priority setting ensuring infrastructure financing and review of program and policy effectiveness.
- Meet the changing public/client needs and priorities - through ensuring an understanding of their needs, the development and implementation of highway safety initiatives, striving for implementation of barrier-free transportation, supporting Alberta's economic priorities, involvement in environmental initiatives through effective policies, planning, design and research and development.
- Encourage an efficient integrated multi-modal system - through revision to the Alberta Railway Act and development of safety programs for provincial railways, preparation and submission of impact to national policy initiatives to facilitate the development of multi-modal transportation systems which meet Alberta's needs.

### **9.13.3 Proposed Investment Level**

AT&U proposed to invest \$7.29 million in R&D and RSA in 1993/94, on projects contributing to the above objectives. With the continuing decrease in the departmental budget, the 1994/95 R&D and RSA activities are expected to decrease also to \$6.95 million. The continual erosion of the R&D budget is having some serious consequences, e.g., the cooperative research program with Alberta Research Council has fallen from an all time high of \$435,000 in 1984/85 to \$265,000 each in 1993/94.

**TABLE 9.13.1 S&T INVESTMENTS**

	93/94 Estimated R&D      RSA (\$ Million)		94/95 Proposed R&D      RSA (\$ Million)	
Design, Operation and Maintenance of Transportation System	0.788	0.711	0.668	0.603
Bridge Engineering	-	0.045	-	0.047
Design Engineering	0.120	-	0.116	-
Roadway Planning	-	1.089	-	1.013
Materials Engineering	0.14	0.945	0.13	0.879
Urban Transportation	0.160	-	0.149	-
Environmental Impact Studies	-	0.155	-	0.660
Traffic Volume Analysis	0.270	1.408	-	1.309
Analyses of Highway Use and Safety (Social Science and Humanities)	<u>-</u>	<u>1.457</u>	<u>-</u>	<u>1.318</u>
Subtotal	1.478	5.810	1.063	5.891
Grand Total	7.288			6.954

#### **9.13.4 Organizations Involved**

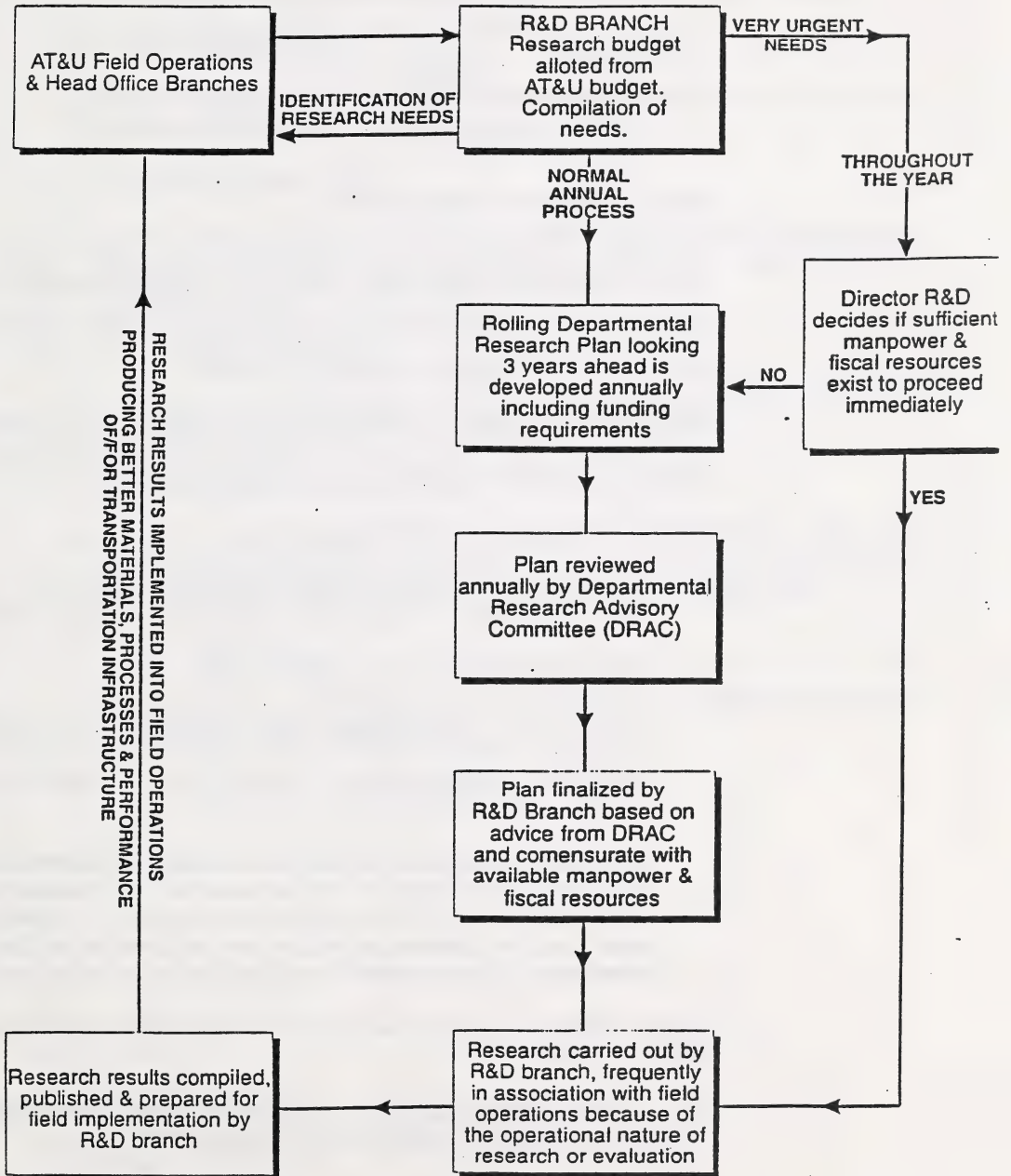
R&D and RSA activities identified under "Design, Operation and Maintenance of Transportation System" follow a planning and execution process as shown in figure 9.13.1, and are carried out by research staff and field operational staff to the fullest extent possible to ensure rapid and effective technology utilization and implementation in departmental operations. Certain longer term projects are done cooperatively with Alberta Research Council and the Alberta universities. These projects are negotiated directly making effective use of expertise and equipment in these two organizations. The department actively pursues and contributes financially and technically to cooperative research programs interprovincially, nationally and internationally where it can lever up it's investment in research.

The rest of the R&D and RSA activities pursued by the department are predominantly technical surveys in support of planning and design, and quality control tests in support of construction and rehabilitation activities. These are scheduled yearly on an "as required basis".

Approximately 85 departmental staff will be involved in these R&D and RSA activities and it is estimated that up to 20 people outside the department will be supported by this investment.

Figure 9.13.1

## AT&U PROCESS FOR R&D ACTIVITIES





### 9.13.5 Key Program Elements

1. Improvement in the design, maintenance and operation of the transportation physical plant (highways, roads, bridges, airports).

94/95 Investment	R&D (\$ Million)	RSA	Total
	0.668	0.603	1.271

- **Internal Component - \$0.831 million**

Will focus on completion of outstanding projects from 1993/94 which currently number about 40 and initiation of 10 - 15 new ones. Projects are directly related to improvement of construction materials, rehabilitation techniques and processes for both pavements and bridges, safety, environmental aspects, recycling, emissions control, surveying techniques and technology transfer.

Each of these activities will ensure maximum safety and convenience to the motoring public. It will also protect the roadway infrastructure and ensure longer and better performance, thus in the end benefiting the provincial taxpayer.

- **Extramural Component - \$0.44 million**

- Co-operative R&D with the Alberta Research Council and universities. Improved performance of pavements, bridge structures and hydraulics.
  - Participation in national and international R&D.
  - Participation in the USA Strategic Highway Research Program (SHRP), and the associated Canadian C-SHRP program, provides access to major advanced transportation research programs, investigating asphalts, pavements, concrete structures and highway maintenance operations.
  - Participation with Research Development Council (RDC) provides access to research conducted into roads, infrastructure and environmental matters of national importance. These programs will ensure that our roadway system meets acceptable standards at minimal cost and provides the best roadway system under the environmental conditions experienced in the province.
2. Roadway Planning (to provide technical information needed to design the Alberta highway system).
- almost entirely technical surveys of existing and proposed highway infrastructure, including long range planning for right-of-way requirements.

### 3. Materials Engineering

- a modest sum is spent on materials research, however the majority is for quality control during construction, technical surveys for pavement structural design, assessing pavement condition and performance for planning rehabilitation needs.

### 4. Urban Transportation

- involves co-funded R&D and RSA projects with 12 Alberta cities to provide better, safer and more efficient urban transportation systems.

### 5. Environmental Impact Studies

- involves special projects to assess the environmental impact of the highway system to protect historical and biophysical resources. This activity requires additional funding and resources for the future.

### 6. Traffic Volume Analyses

- primarily technical acquisition of the traffic volume statistics needed to design and improve the highway system due to increasing traffic volumes.

### 7. Analyses of Highway Use and Safety

- primarily technical surveys related to transportation safety, accident analysis, and infrastructure damage assessment to improve highway safety, protect against potential liability claims, and provide convenience to the motoring public.

### 8. Bridge Engineering

- involves surveys to determine scour in river beds so as to maintain bridge structure integrity and to ensure public safety.

## Co-operative Research Funding 1993/94 (R&D)

Project/ Program	FUNDING (\$)						Total
	AT&U	Alberta Govt.	Other Provinces	Federal Government	International	Industry	
SHRP/C-SHRP	75,000	-	1,005,000	120,000	30,000,000	-	31,200,000
ARC (Materials & Bridges)	265,000	265,000	-	-	-	-	530,000
ARC (Petrographic)	27,000	27,000	-	-	-	-	54,000
RDC	24,000	-	235,300	194,600	-	-	429,900
Testing of Paints for Bridge Applications	36,000	-	36,000	-	-	36,000	108,000
<b>Total</b>	<b>427,000</b>	<b>292,000</b>	<b>1,276,000</b>	<b>314,600</b>	<b>30,000,000</b>	<b>36,000</b>	<b>32,321,900</b>

**SHRP:** United States Strategic Highway Research Program

**C-SHRP:** Canadian Strategic Highway Research Program

**ARC:** Alberta Research Council

**RDC:** Research and Development Council of the Transportation Association of Canada

Most of the research programs shown are of more than one year duration, the table depicts a snapshot in time, e.g., SHRP/C-SHRP are five year research programs whose total value is \$156,000,000. Similar co-operative scenarios may be expected in 1994/95 and beyond.

For an investment of \$427,000, Alberta Transportation and Utilities gains access to \$32,321,900 of research in a given year - leverage ratio of 75:1.

### 9.13.6 Evaluation

The need for research and its relevancy is determined by the Departmental Research Advisory Committee (DRAC). Current evaluation of research is purely internal and is done in conjunction with the client. The prime indication that the research is cost beneficial is the fact that most of our research is implemented into departmental operations, procedures or standards.

### 9.13.7 Program Expansions or Additions

Current staff and monetary resources fall short of the identified needs of the department, and these need to be reconciled.

The Alberta Research Council plans to divest itself of the cooperative program during the 1994/95 to 1996/97 period and alternatives will have to be found for continuing this research at much lower investment levels.



## **Appendix 1**

### **A. Technology and Research Advisory Committee**

\*Dr. B. Barge, President, Alberta Research Council

Mr. J. Bell, Associate Director, Federal & Intergovernmental Affairs

Dr. W. Byrne, Assistant Deputy Minister, Alberta Community Development

Dr. Mr. A. Campbell, Director, Alberta Labour

\*Dr. R. G. Christian, Executive Director, Agriculture Food and Rural Development

Mr. C. L. Dmytruk, Senior Director, Economic Development & Tourism

Dr. R. Fessenden, Vice-President, Alberta Research Council

Mr. J. K. Kleta, Executive Director, Energy

Mr. J. Konarzewski, Director, Alberta Transportation and Utilities

Ms. C. Lord, Assistant Deputy Minister, Alberta Health

Ms. L. Tait, Assistant Deputy Minister, Economic Development and Tourism

\*Dr. C. Reichert, Secretary, Technology and Research Advisory Committee

Dr. M. Spence, President, Alberta Heritage Foundation for Medical Research

Dr. A. Vanterpool, Secretary, Premier's Council on Science & Technology

Dr. M. Wilson, Director, Alberta Environmental Centre, Alberta Environmental Protection

Mr. P. Hill, Director, Advanced Education and Career Development

Dr. R. Luhning, Chairman, Alberta Oil Sands Technology & Research Authority

\*S&T Activities Overview Task Group

## **Appendix 2**

### **SUMMARY OF RECOMMENDATIONS 1993/94**

#### **Recommendation 1**

**The Alberta Government should develop a long term Science and Technology (S&T) plan with strategies for implementation which clearly establish the priorities for its departments and agencies.**

- 1.1 The S&T plan developed with input from industry, the health sector, relevant community groups, and the Premier's Council on Science and Technology must be an integral part of the economic and social plan of the Province and connected to Toward 2000 Together.
- 1.2 Within the context of a Provincial S&T Plan, an implementation strategy should be developed to guide appropriately balanced investments in basic research, applied research and technology development and training.
- 1.3 Within the context of a Provincial S&T Plan an implementation strategy should be developed for the dual technology focus which was set out as recommendation 1.3 of the 1992/93 Research Overview.

#### **Recommendation 2**

**Each Alberta Department and Agency should develop long-term R&D plans with long and short term strategies for implementation and including the expected impact of the activities. Approvals for these plans should be sought through Request for Decision (RFD).**

- 2.1 An ongoing review of all government R&D programs should be undertaken including an analysis of how effective the research funding has been including a statement of the economic and social impact and the changes that can be made to improve effectiveness.
- 2.2 All new research and development programs should contain an economic, environmental and social benefit/impact statement. Each program, grant etc., should indicate how and who will implement the science or technology which will be developed.
- 2.3 The budget of multi-year programs should be committed for the term of a program to allow departments and agencies to have more flexibility to develop cooperative research ventures with other organizations, and better plan and manage their financial, human and capital resources.

#### **Recommendation 3**

**Departments and Agencies which perform and fund research should be given the ability to manage their funds over periods longer than one year by having approved rolling 3 to 5 year plans, with the requirement to carry forward surpluses and deficits into the following year.**

- 3.1 Departments and Agencies with specialized expertise and equipment needed by others should be given the ability to retain revenue for services provided on a fee-for-service basis.

#### **Recommendation 4**

**Departments and Agencies should develop plans to ensure and maintain a high level of human resource capability and facilities to achieve their mission and goals.**

- 4.1 Departments and agencies should develop plans for appropriate hiring and training practices to ensure their human resources reflect future needs of the organization.
- 4.2 Departments and Agencies which have aging equipment and instrumentation should develop plans for recapitalization to maintain an appropriate balance among investments in manpower, supplies and services and capital.



## **RECOMMENDATIONS FROM 1992/93**

### **Recommendation 1:**

**The Alberta Government should make technology-based industrial competitiveness a major goal for this decade.**

#### **1.1 Establish and Maintain a Technology Strategy Focused on Industrial Competitiveness**

The Alberta Government will need to devote more attention to research and technology if Alberta wishes to remain a key player in highly competitive and technology-sophisticated world markets. The Alberta Government should make technology competitiveness a major goal in its programs for this decade. Each Department and Agency should have a well developed technology plan, which is integrated with its overall strategic plan. A comprehensive government technology strategy should be developed and brought into sharp focus prior to reviewing the budget requests of individual Departments and Agencies.

The public discussions on "Toward 2000 Together" should help in the preparation of an overall strategic plan for the Province.

#### **1.2 Include the Following Elements in the Technology Strategy**

- Linking our natural resource/high technology strategies
- Emphasizing key emerging technologies as new economic wealth-generators
- Balancing short and long term objectives
- Supporting infrastructure for key sectors
- Preserving our environment
- Developing effective working arrangements with the private sector
- Expanding interdepartmental collaboration

#### **1.3 Continue to Support a Dual Technology Strategy, with Improved Linkages**

The Alberta Government should maintain its dual strategy of (a) utilizing technology to enhance natural resource development, and (b) stimulating high technology industries. Programs which provide a close linkage between these two thrusts should be supported. Focusing our high technology capability of the technological needs of the resource industries will have a double benefit. It will help ensure the survival of the wealth-generating capability of the resource industries, and at the same time, will give high technology companies an opportunity to test and refine their products in the domestic market. Support for the high technology sector will help diversify the economy by connecting Alberta to new product opportunities and rapidly growing world markets.

#### **1.4 Enhance Interdepartmental Coordination Through Co-funded, Co-managed Programs**

The complexity of today's social and economic issues requires a high level of interdepartmental planning and cooperation. The development of joint programs in areas where there are overlapping mandates is an effective way of providing cost-effective and unified programs. Research, which provides the direction to the future, is an important area for such interdepartmental collaboration.

#### **Recommendation 2:**

**The Alberta Government should increase and maintain its research investment at \$300 million per year.**

##### **2.1 Set Our Annual Research Investment at \$300 Million, the Investment Needed to Return to Mid-1980 Activity Levels**

Our research investments have served us well in the past, and will be crucial in meeting global competition. Investment in science and technology will lead to expansion in our gross domestic product and larger government revenues. The increase in research investment should be in those areas where deficiencies in the application of new technology are impeding the attainment of a globally competitive economy. The areas for immediate examination include:

- high speed telecommunications network
- geographic information systems
- product upgrading in agriculture, energy and forestry
- simulation technology to reduce the cost of direct experimentation in the resource sectors
- health care and occupational health products and practices
- environmental products and practices
- high performance computing/information technologies
- an appropriate commitment to basic science in areas important to our long term interests
- information technology as basic support to all industry

##### **2.2 Increase the Emphasis on Environmentally Sound Resource Development**

In the future, advanced technology will be required to extract and upgrade natural resources with significantly reduced environmental impacts, and with a higher level of health and safety protection for workers and the general public. The Alberta



Government should ensure these aspects are effectively entrenched in its technology plan. Business opportunities arising from the expertise developed in these areas should be captured.

### **2.3 Expand the Role of TRAC in Recommending Specific Research Programs**

The specific programs for enhanced investment should be recommended by the Technology and Research Advisory Committee (TRAC), using the information in the Research Overview Report as major input.

### **Recommendation 3:**

**The Alberta Government should put top priority on programs to substantially increase the industrial commitment to R&D.**

#### **3.1 Develop Appropriate Working Arrangements with the Private Sector**

Alberta Government Departments and Agencies should develop an appropriate set of working arrangements with the private sector, which reflect the maturity of the sector involved, and the role of government in that sector. These working relationships should change with time, reflecting the increasing sophistication and capability of the private sector.

#### **3.2 Seek Industrial Support for Co-Funded Programs**

Alberta Government Departments and Agencies should develop plans to stimulate additional research investment by industry, using the enhanced funding in recommendation 2.1 for new co-funded programs.

#### **3.3 Continue to Support Technology Infrastructure Required by Industry**

The Alberta Government should continue to support the increased application of new technologies to industry through research infrastructure support, testing facilities, research consortia, technology institutes, advanced education, technology transfer, business counselling, and trade promotion. Industries involved in the new technologies are growing at twice the rate of other sectors. If Alberta wishes to participate in this growth, a well-developed network of technology support will be needed by Alberta's small but aggressive private sector participants.

#### **3.4 Publicize Past Research Accomplishments**

The Alberta Government should ensure that the high pay-out from past investments in research are known outside the specific sectors involved. The dramatic record of past industrial research accomplishments should be publicized as a stimulus for future investments.





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